AVAILABILITY OF INFORMATION FROM FEDERAL DEPARTMENTS AND AGENCIES

PART 15—Restrictions on Flow of Scientific and Technological Information

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HEARINGS

BEFORE A

SUBCOMMITTEE OF THE COMMITTEE ON GOVERNMENT OPERATIONS HOUSE OF REPRESENTATIVES

EIGHTY-FIFTH CONGRESS

SECOND SESSION

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AVAILABILITY OF INFORMATION FROM FEDERAL DEPARTMENTS AND AGENCIES

Part 15—Restrictions on Flow of Scientific and Technological Information

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MONDAY, JANUARY 20, 1958

HOUSE OF REPRESENTATIVES,
SPECIAL SUBCOMMITTEE ON GOVERNMENT INFORMATION,
OF THE COMMITTEE ON GOVERNMENT OPERATIONS,
Washington, D. C.

The subcommittee met, pursuant to call, at 10:08 a. m., at the George Washington Inn, New Jersey Avenue and C Street SE., the Hon. John E. Moss (chairman) presiding.

Members present: John E. Moss, Dante B. Fascell, and Clare E. Hoffman.

Also present: John J. Mitchell, chief counsel; Samuel J. Archibald, staff administrator; Paul Southwick, professional staff member; Robert F. Coll, investigator; Ralph Widner, staff assistant; and Jack Howard, staff assistant.

STATEMENT OF CHAIRMAN JOHN E. MOSS

Mr. Moss. The subcommittee will now be in order.

I have a statement I would like to read at this time.

The American scientist, now engaged in a deadly race with his Russian counterpart for mastery of space, is handicapped by two information problems.

The first is excessive Government security regulations that have placed unwarranted curbs on his intellectual freedom and that question his honesty and patriotism. The other problem is the rising tide of published information that threatens to engulf the scientist by its volume.

This is a paradox of too little information on the one hand but too much in a useless form on the other.

SECURITY-SECRECY REGULATIONS

The problem of oppressive security regulations could be solved by realistic revisions of secrecy rules. Such revisions could produce a stimulating effect on science almost at once.

In hearings before the House Government Information Subcommittee in March of 1956, a panel of distinguished scientists warned that the Nation could not buy security with secrecy. They urged the

calculated risk of releasing certain basic scientific findings in the tradition of American intellectual freedom. These scientists asserted that this easing of oppressive security would stimulate our scientific progress and at the same time give the world a dramatic example of America's devotion to the principle of freedom.

This advice was ignored.

Now the Congress has been asked by President Eisenhower to ease restrictions on the international flow of scientific data to our allies. It is proper to ask the President whether, by administrative directive, the Pentagon will extend the same courtesy of supplying more Government information to our own scientists, universities, and industries.

MACHINE TRANSLATION, SEARCH, AND RETRIEVAL

The solution to the second problem—how to cope with the mounting mass of published findings from the world's laboratories and universities—may lie with the scientists themselves.

Some scientists hope, in the future, through electronic devices to summon all of man's information on any given subject at the touch of a button. Our scientists currently are working on machines to translate foreign languages into English. They also are working on machines that will search out and produce all writings on a subject once they have been fitted into the machine's electronic memory.

But these hoped-for solutions to the problem of collecting basic scientific information in a usable form may lie too far in the future to be of practical value in the current race toward space. There is, for example, much confusion over what to do about translating the rest of the world's scientific literature—including Russian—into English. The Government is translating some of this material but disregarding most of it. The subcommittee hopes to find out the scope and effectiveness of this translation program.

SCOPE OF THE INVESTIGATION

The subcommittee plans to continue its study of the scientific information problems by, first, taking a careful, objective look at the methods scientists use to gather information. We will study also Government programs underway or planned to help make scientific information available and we will then seek advice on solutions of the scientific information problems. Our need is for a freer flow of scientific information without impairment of the real security of our Nation.

Before we hear from Dr. Berkner, I wonder, Mr. Hoffman, if you have any statement or any observations you would like to make at this time.

Mr. HOFFMAN. Thank you, Mr. Chairman.

As a third of the committee, permit me to call the attention of the press to the second paragraph in the statement.

Two complaints are made: One that the Government conceals from the scientists information which it is necessary for them to have in order to develop a proper production program, and the other, in the same paragraph, is that the Government dumps too much information on them. They are bewildered by the volume of it.

One other observation: The first part of the paragraph suggests that the existence of certain security regulations in a reflection upon the honesty and the patriotism of the scientist.

I beg leave to differ with my chairman on that one. How any of those regulations can reflect upon the integrity and patriotism of a scientist is beyond me. It doesn't seem to be proper to charge that, because those who are in authority and whose duty it is to promulgate these regulations issue a certain regulation or a group of regulations, they are charging scientists with being disloyal. That conclusion, in my mind, just does not follow.

Thank you, sir.

VOLUME OF SCIENTIFIC INFORMATION

Mr. Moss. I would make only one observation. In the second paragraph of my statement, I am not referring to too much information available from Government sources but rather an increasing volume of scientific information from all possible sources. This does pose a problem, as I think the testimony of the next two witnesses and those scheduled for the hearings on Tuesday and Wednesday will amply demonstrate.

Mr. HOFFMAN. I am glad to have that statement, Mr. Chairman, because reading the paragraph as a whole—and both statements are in one paragraph—the average citizen would in my opinion draw the inference that they are just dumping too much onto the scientist.

Mr. Moss. Dr. Berkner, I believe you have a statement.

STATEMENT OF LLOYD V. BERKNER, PRESIDENT, ASSOCIATED UNIVERSITIES, INC.

Dr. BERKNER. Mr. Chairman and members of the committee, I am very happy to respond to the invitation of the committee to discuss the problems related to the interchange of scientific information in the interest of improving scientific progress.

Human welfare and the advance of civilization have become so dependent upon technology emergent from science that a healthy science program has become the concern of every citizen. But the benefits of science are not economic and material alone—they enter to an ever-increasing extent in the human affairs of mankind—the literature, poetry, and humor—by expanding man's comprehension of his environment. World reaction to scientific earth satellites illustrates clearly the extent to which genuine search for knowledge endows the originator with a position of respect and strength among the nations of the world. As I recently mentioned in Foreign Affairs (vol. 36, No. 2, January 1958, pp. 221–231):

> Leaders of the Soviet bloc are now capitalizing on intellectual leadership as a means of acquiring an essential element of what Milovan Djilas calls the inherent need of those in power to be recognizable prototypes of brilliance and might (The New Class, New York, Praeger, 1957).

Consequently, it is not only desirable but also necessary to political leadership to sponsor a genuine and effective scientific activity to qualify that leadership in the eyes of the people of the world.

DEFINITION OF SCIENTIFIC RESEARCH

Scientific research involves not only the search for and discovery of knowledge, but also the general disclosure of that knowledge. In fact, the definition of the word "discovery" involves both finding, and disclosure and dissemination. Access to scientific information is a major element in the growth of science of any nation. Likewise, scientific stature is only acquired by disclosure of scientific results so that their reliability can be tested and evaluated and their real meaning to the advancement of knowledge realized and understood.

Fundamental to the dissemination of all scientific information is the requirement that it be in form to ascertain and test the veracity of the findings.

INEFFICIENCY IN RESEARCH

Perhaps the greatest inefficiency in research arises from conduct of experiments, often expensive, in absence of knowledge that the same essential elements of the research have already been done somewhere else. While it is often necessary to repeat a given experiment to test reliability of the result or to acquire skill in a new technique, it is inexcusable and frustrating if scientific work proceeds without knowledge or recognition of reliable research already done elsewhere. Yet in absence of reliable access to scientific information, the probability of such unknowing duplication and waste is immensely enhanced.

TRANSLATION OF RUSSIAN PUBLICATIONS

At the moment, for example, our access to Russian scientific literature is relatively poor. This is not so much due to the effectiveness of the Iron Curtain as to the lack of acquisition of what is available and of translation and circulation of Russian scientific literature in a form and under circumstances that make it readily available to American science. Since the Russian effort in science and technology amounts to several billion dollars a year, the saving through access to Russian science must amount to many times the cost of providing such access. Moreover, with prompt knowledge of Russian scientific advances, American science could promptly build on these advances without loss of time in spading over the same ground. The Russians have organized to capitalize on such economies and to further their stature by establishment of the Soviet All-Union Institute of Scientific and Technical Information that employs more than 2,000 scientists in reading, translating, and abstracting scientific articles from journals all over the world. These translations and abstracts are then disseminated in excellent printed form to working scientists in every part of the Soviet Union.

ELEMENTS OF INTERCHANGE

The basic elements of interchange of scientific information are:

1. Personal presentation and discussion: This is usually done at national or international scientific meetings or through personal contact or communication under circumstances that permit questions and discussions so that the methods, procedures, and conclusions can be fully exposed, evaluated, and interpreted for their value as contributions to knowledge.

2. Publication in scientific journals: In formal publication the scientist definitely commits himself to his conclusions and to the procedures by which they were derived.

3. Translation and public circulation: This is essential to removal of language barriers to scientific progress.

4. Abstracts: Abstracts provide an aid to discovery of relevant literature and the means for quick assessment of the worth and applicability of a scientific publication.

5. Bibliographies: These provide lists of titles and general knowledge of the character of work done by individuals or at laboratories.

6. Classification and indexes: Indexes based on proper classification are an essential element to disclosing existence of scientific papers or references to specific objects.

7. Retrieval: In a large volume of scientific literature retrieval of all material relevant to a given subject involves a systematic search procedure to disclose the relevant material and only that material which is relevant.

I shall briefly discuss each aspect of this process of interchange as it applies to the United States science at the moment.

PERSONAL CONTACT AND COMMUNICATION AMONG SCIENTISTS

The value of personal contact between scientists cannot be overestimated. The opportunity for scientists to work together for intervals of a few weeks, or months, permits detailed comprehension of new scientific advances or methods and the transfer of knowledge from scientist to scientist in the most effective way. Moreover, the interaction among scientists in the synthesis of ideas is most beneficial. Consequently, awards of fellowships for travel, study, and research for substantial intervals is repaid many times over in the ideas that emerges. The foundations, both private and public, have served science well in this respect, but the ever-increasing needs for fellowships should be met by greater public support.

RESTRICTIONS ON PERSONAL CONTACTS

Turning to personal communication, there is one aspect that is especially worthy of emphasis. Less than 3 years ago, United States scientists were not permitted by our Government to transmit the results of unclassified Government-supported research to Soviet orbit nations. Thus, the establishment of exchange arrangements on a personal basis was impossible.

These restrictions have now been officially relaxed, but many United States scientists, and their institutions, are still under the misapprehension that such exchanges are frowned upon by the Government and that to communicate with a Soviet scientist is to court attack upon their loyalty and character. The United States Government might well take steps to effectuate the new policy by giving positive encouragement to United States scientists to establish such exchange arrangements for unclassified information. These will not only help foster international good will among scientists—and, I might add, others—but will also bring into this country much scientific information which has been unobtainable through regular literature channels. United States scientists who receive material from foreign sources on a personal basis

should also be encouraged to forward it to an appropriate central agency in this country, which would evaluate, abstract, translate (if necessary), and disseminate it widely.

WORKING EXCHANGE AGREEMENTS

A number of working exchange arrangements have recently been established between AEC contractor laboratories and Soviet laboratories, with results useful to the United States. But in view of the considerable efforts the U. S. S. R. has made for many years to obtain all United States scientific material of possible value, and the difficulty United States agencies are experiencing in obtaining like materials from the U. S. S. R. through official channels, it is probable that personal exchanges will produce more scientific dividends for the United States than for the other parties to the exchanges.

Exchanges of this kind have already been most effective.

NATIONAL MEETINGS

The national societies in diverse fields of science offer opportunity for scientific meetings and for extended symposiums by learned scientists in disclosing and discussing results of scientific research. On the whole, the activities of these societies appear sufficient and adequate for the purpose. This type of activity can conceivably be pushed too far in diverting the scientist from his work far too large a proportion of his time. But such meetings are imperative, not only to exchange but also to evaluate scientific advances.

INTERNATIONAL MEETINGS

Internationally, scientists meet at assemblies of the scientific unions, at scientific congresses, at international special symposiums, and the like. Perhaps the most generally important group of international scientific activities is sponsored by the International Council of Scientific Unions, of which there are 14.

International Astronomical Union
International Union of Biological Sciences
International Union of Pure and Applied Chemistry
International Union of Crystallography
International Union of Geodesy and Geophysics
International Geographical Union
International Union of the History and Philosophy of Science
International Union of Theoretical and Applied Mechanics
International Union of Pure and Applied Physics
International Scientific Radio Union
International Mathematical Union
International Union of Physiological Sciences
International Union of Biochemistry

These unions are organized under the International Council of Scientific Unions (ICSU), of which I have the honor of being President.

The international unions have functions of—

1. Organization of regular international assemblies to hear papers and discussions on scientific progress;
2. Organization of international symposiums to explore and publish synthesis of scientific status of special projects;

3. Establishment of international standards of scientific nomenclature and procedures to standardize scientific methods and literature and keep it accessible to all of science;

4. Review and stimulation of neglected areas of science that may be retarding growth of scientific knowledge generally; areas;

5. Encouragement of scientific activity in underdeveloped areas;

6. Cooperation in special research activities, such as the International Geophysical Year.

The International Council of Scientific Unions coordinates the common interests of the unions, aids in the financing of union activities through cooperation with UNESCO, organizes special commissions to examine scientific problems of interunion interest, organizes special committees to plan international research activities such as the International Geophysical Year, and sponsors international scientific services such as the Bureau of Permanent Services and the ICSU Abstracting Board, which I shall mention later.

RESTRICTIONS ON MEETINGS IN UNITED STATES

The role of the unions is so important to the flow of scientific information that it is unfortunate under existing application of foreign policy that many such unions cannot be invited to meet in the United States. Consequently, American scientists are forced in many cases to go abroad, and sometimes to Moscow, to enter into the normal processes of interchange of scientific information.

NATIONAL SCIENTIFIC PUBLICATION

Publication of scientific papers is effectuated through—

1. Scientific and technical societies in their journals;

2. Commercial and Government scientific and technical journals;

3. Government reports;

4. Volumes of symposiums, monographs, and textbooks.

To science, publication of scientific societies has traditionally been most important. At the moment, these publications with a few exceptions, are in serious trouble. Publication through scientific societies has the great advantage of careful and objective review and refereeing of each scientific paper before publication to delete frivolous or second-rate material, and to aid the author in errors or composition through review of his work by competent, but disinterested, fellow scientists. While in technology publication expenses of societies are paid by income from advertising, technical exhibits, and professional activities, as well as from membership dues, in science the limited appeal restricts sources of income almost solely to membership dues. With increasing volume of scientific publication, many scientific societies are being driven to the wall by their publication costs. Consequently, publication of important scientific material is delayed and sometimes must be refused. Membership dues to scientific societies have been pushed to the limit, and, as an example, for me, personally, dues to the several scientific societies amount to several hundred dollars annually. This is a severe burden on young

scientists who must need ready access to the meetings and journals of societies in their field. Most certainly, new forms of revenue or public subsidy are essential to maintenance of the journals of most scientific societies. Failure to find such revenue is already damaging American science, and this damage will become more severe in the future.

GOVERNMENT REFUSAL TO PAY PAGE CHARGES

The Federal Government can do much to aid. At the moment, many Government agencies refuse to pay page charges levied for publication of scientific researches done under their sponsorship. It is said that these restrictions are imposed by law or ruling of the Comptroller General. Yet it seems utterly ridiculous that agencies financing research should not also finance publication of results of such publicly financed research by the most appropriate method. Certainly, the Congress should act, not only to remove this financial restriction, but also to require publication of Government-sponsored research, wherever possible, in reputable scientific journals so that Government-sponsored work can enjoy the review and refereeing that insures its quality.

GOVERNMENT RESEARCH REPORTS

The publication of Government reports of unclassified research is seriously defective. In many cases such reports receive only limited and perhaps even preferential distribution, and they are often not in form to be regularly accessioned and classified in the libraries. Consequently, such reports are often buried and not available for reference. In this way much valuable Government research is buried, only to be repeated again at great cost. In lieu of such reports, wherever possible, Government agencies should employ the standard forms of scientific and technical literature or standard monographs, and contracts for research should accept standard scientific publication as an adequate report of work sponsored. Indeed, acceptance of work for publication in a reputable journal might be a criterion of satisfactory performance. But at the moment, agency restriction on payment of publication costs encourages rather than discourages the publication of independent reports that are disadvantageous to scientific progress.

There are situations, particularly in the field of engineering and when classified reports receive security declassification, when publication of scientific information in report form is almost inescapable. In such cases, positive action must be taken to have the reports and abstracts supplied to the appropriate abstracting journals. In addition to free copies being sent to all other Government agencies having a possible interest in it, it should be made available for public sale through an official sales agency, for example, Office of Technical Services or Superintendent of Documents. Copies should also be sent to the Government depository libraries that have been established all over the country. The pattern established by the AEC in this respect might well be copied by other agencies.

PRICE INCREASE ON GOVERNMENT DOCUMENTS

In connection with the sale of Government reports, it is regrettable that the price scale for documents on sale by OTS has been recently increased by several hundred percent. For example, a 200-page report formerly priced at $1.25 must now be sold for $5. This has substantially reduced its availability to American scientists, but of course not to foreign libraries that have adequate funds to purchase and translate the report. Presumably, this increase reflects an attempt by the Government to have its reports pay for themselves—surely an unrealistic attitude when it is so vital to disseminate scientific information to the greatest possible extent.

The effectiveness of the Government depository libraries is essential to the effective availability of reports, but it is doubtful if many of these are functioning as they should. They have, perhaps, been underfinanced to the extent that at least some are not very effective. An investigation to ascertain how they can be made fully effective may well repay the effort.

SPECIAL SCIENTIFIC PUBLICATIONS

The publication of special scientific monographs or symposia is often impossible in the United States. Such volumes of exceptionally great importance to science are necessarily specialized and, therefore, because of their limited sale, are rarely successful commercially. Nevertheless, such specialized volumes in every field of science are essential to national scientific effectiveness as they often are the only means of fully developing certain great, but complex, scientific advances. Frequently, their publication involves very expensive and special reproduction of illustrative material. Quite often commercial sales over a very long period of time, say 10 to 50 years, would liquidate the costs, but capitalization of such a venture over this long interval is neither commercially attractive nor feasible by scientific societies. For example, in the case of the American Geophysical Union, there is need for publication of some 25 to 50 monographs covering special developments and symposia on scientific results of the International Geophysical Year and related matters concerning growth of specialized knowledge of planet Earth. This requires subsidy of a rotating capital fund of $50,000 to $100,000, much of which would be recovered from sales in perhaps 2 decades. In fact, such a fund might permanently guarantee the continued publication of monographs by that society. But in absence of such funds, full United States publication is improbable, and United States scientists will be forced to look elsewhere for important interpretative material and this will delay and stifle our progress.

SOVIET MONOGRAPH PUBLICATION

An illustrious American astronomer, who has spent much time in Russia, recently pointed out to me that the Russians were taking advantage of this situation by providing opportunity for publication

of excellent Russia monographs with the best work on illustration. In absence of equivalent publication in English, our scientists will be forced to learn Russian or to go to Moscow to assimilate special studies. Nor are our scientists encouraged to undertake the careful work underlying the preparation of such special publication. Both factors greatly diminish our national scientific stature and opportunity.

We must conclude that with a few exceptions, the financial support for publications of scientific journals, special monographs, and symposia by the scientific societies is now bad. With increasing scientific activity it is growing steadily worse. Our national interest requires either private or public subsidy or both. The cost of such subsidy would be relatively small, perhaps 2 or 3 million dollars a year for the whole job, compared to the great scientific and national advantages to be gained.

INTERNATIONAL SCIENTIFIC PUBLICATIONS

International publications of international symposia, agreed standards and procedures, and other scientific matters of fundamental importance has enjoyed negligible support. The present total of United States support to the International Council of Scientific Unions and its 13 unions for meetings and publications has been $9,000 per year for annual national dues, with recently some small augmentation from the private funds of the National Academy of Sciences. The Senate has passed a bill, now awaiting action of the House of Representatives, to increase the authorization to $62,000 annually. This urgently requires action. The principal support of the international unions for all activities is $175,000 granted annually by UNESCO and divided appropriately by ICSU among the 13 unions. Very much stronger financial support of the international unions by the United States would be greatly repaid in terms of scientific progress and publication.

TRANSLATION PROGRAM OF UNITED STATES

Translation of foreign language, particularly Russian literature, into English is in rather weak condition at the present time. Such translations, to become effective reference literature, should appear whenever possible as regularly established journals that can be regularly accepted in the laboratories.

The costs of prompt translation and publication, without possibility of advertising income, make unit subscription for such translated journals prohibitively high and not commercially feasible. The few existing journal translations have been subsidized on a small scale by a number of private foundations, scientific societies, the Atomic Energy Commission and the National Science Foundation. The funds from all these sources are severely limited. Here substantial Federal subsidy is justified, because of the resultant saving through elimination of duplicate research, and even more important, earlier information of important advances abroad. The matter of adequate funds for translation needs urgent attention.

CLASSIFICATION OF TRANSLATIONS OF OPEN LITERATURE

Very curiously, a number of Government agencies making translations of open foreign scientific literature are reported to be restricting circulation of such translations by security classification. Because of such restrictions, the same scientific article is often translated several times by different agencies. In one case, a Russian paper was reported to me to have been translated several different times, each in ignorance of the earlier translation by the Government. Not only do such procedures seem wasteful, but they deny the information to American science generally where it might be most effective. It is difficult to understand what advantage is gained by security classification of such open scientific literature.

NEED FOR TRANSLATION PROGRAM

The urgent need for adequate translation of open foreign-language scientific journals and their prompt circulation in the standard forms of scientific literature dictates that this process be carried on efficiently. A central agency, such as the National Science Foundation or Office of Technical Services should be designated as a central agency to which all such scientific translations are supplied for publication and circulation. Such an office should be authorized to contract for private publication in accordance with the usual practice for scientific literature. No translation should be started before checking with this central clearinghouse, to insure that the item in question has not already been translated elsewhere.

ABSTRACTS

The scientific abstract is a principal method of finding relevant scientific literature and of obtaining a broad feeling for the scope of progress in a scientific field. Used in conjunction with a good classification index, the abstract provides the scientist with a means of quick assessment of material relevant to his problem. Ideally, in each principal scientific discipline, one abstracting journal for each of the 3 or 4 scientific languages (English, French, German, and Russian) should be adequate. A multiplicity of abstracting journals in the same language is bad, since it involves much duplication and imposes a severe added load on the scientist and librarian. Perhaps the worst situation occurs in biology where morethan 60 abstracting journals ranging from general to highly specialized succeed in thoroughly confusing the problem. While duplication cannot be entirely eliminated, great improvements are certainly possible.

ABSTRACT PUBLISHERS

Abstracting journals are published principally by important national scientific societies or by commercial enterprise. Both have been reasonably successful. To be effective, abstracts must appear quickly after original publication. Among the important scientific abstracting journals in English are Physics Abstracts in Great Britain, and Chemical Abstracts and Biological Abstracts and Nuclear

Science Abstracts in the United States. Great abstracting journals such as these are supervised by dedicated men who do their best with the resources at hand.

An important aspect of adequate publication of abstracts is the prompt production of abstracts themselves at the time of publication in the original journal. A further aspect is prompt provision of every pertinent journal to the appropriate abstracting journal for inclusion of its abstracts.

PROBLEMS OF ABSTRACTS

Thus, there are three major problems in the field of abstracting:

1. Composition of a suitable abstract for each scientific paper;
2. Prompt provision of all scientific journals containing suitable abstracts of their papers to the appropriate abstracting journals;
3. Compression of abstracting journals into the fewest practical number in each principal scientific language.

IMPROVEMENT OF ABSTRACTS

To encourage better production and publication of abstracts after World War II, the International Council of Scientific Unions established the ICSU Abstracting Board, with financial support of UNESCO, to coordinate and improve abstracting in physics. This Board succeeded in confining abstracting journals in physics to one each in French, English, German, and Russian. It has greatly improved coverage of scientific journals abstracted in each language. It has increased the speed of publication of abstracts by air transmission to abstracting journals of page proofs of scientific journals before their publication. It has encouraged translation of abstracts for publication. It has adopted the policy of author abstracts under strict international rules of abstract composition so that such abstracts are both brief and complete. Recently, the ICSU Abstracting Board, on the basis of its success in physics, has been invited to carry its efforts into the fields of chemical and of biological abstracting.

The state of abstracting is still far from satisfactory and the United States has far to go in adopting and supporting adequate policies. University training of our scientists to adequate responsibilities in their scientific writing and abstracting seems imperative. Advice and aid to United States scientific journals in proper abstracting in accordance with ICSU rules and prompt transmittal of page proofs to abstracting journals is needed. Aid to abstracting journals for translations is imperative. Additional support to ICSU Abstracting Board would improve contributions of other nations to the whole effort. Science attachés of the Department of State under the newly reactivated plan can aid by arrangement for prompt transmittal of foreign journals for translation and abstracting, and they can influence foreign publications to adopt acceptable abstracting procedures. One of the most important immediate steps would be the translation of the entire series of the Soviet bloc Referativnii Journal which issues an estimated 120,000 abstracts per year, in all fields of science.

INDEXING, SUBJECT CLASSIFICATION OF SCIENTIFIC LITERATURE

Adequate classification and indexing of content of all scientific articles is fundamental to effective search and retrieval of all information relevant to any subject. The objective is to direct attention to the relevant material and to reject all irrelevant material.

The present status of subject classification is deplorable, and the subject classifications of most scientific disciplines have not been reviewed or developed for many decades. This is principally for want of funds to develop internationally agreed subject classifications. I believe in physics it is 4 years combined.

Improper or arbitrary subject classification can be very dangerous since it can lose or reject important relevant scientific papers. A multicoordinate system of classification is required. By this is meant classification of each paper, so that if an engineer, or physicist, or biologist, or chemist asks a question in the language of his own science he can acquire a paper that may be relevant even though it has been written by a scientist of a completely unrelated discipline. Only in this way can the relevant material of diverse scientific disciplines be integrated and synthesized on any problem and unnecessary duplication of research eliminated.

No multicoordinate system of classification has yet been developed to my knowledge, though progress has been made in the field of atomic energy. To develop a system will require extensive research and many actual trials. Such research is urgently needed and might well be sponsored by the National Science Foundation.

RETRIEVAL

Finding of relevant scientific information now largely depends on memory of scientists of the papers or abstracts that they have read, and on perusal of indexes of abstracting journals. This is an inefficient and defective method, since few scientists have time to keep fully abreast of the immense volume of knowlelge contained in the scientific literature of many languages. It is likely that computing-machine methods, coupled with an adequate means of subject classification and abstracting, will come closer to a general solution of identifying and assessing the scientific material relating to a general solution of identifying and assessing the scientific material relating to a particular problem.

With the development of adequate means of identification and assessment, means of acquisition of the relevant papers can be provided by the great libraries, which must also be able to provide prompt translation of relevant but previously nontranslated papers.

SOVIET ALL-UNION INSTITUTE

These, then, are some of the problems and issues that have led to the foundation of the Soviet All-Union Intitute of Scientific and Technical Information. No equivalent means for solving these problems are available to the Wesetrn World. Quite evidently, however costly, the solution would economize on research effort and give our Nation and

the Western World full access to the scientific activities of others. Consequently, I would recommend five steps:

BERKNER RECOMMENDATIONS

1. Immediate support through the National Science Foundation of scientific journals and specialized publications to permit and encourage prompt and full-scale publication in our language of scientific literature and provide for its adequate abstracting.

2. Provision for encouragement and financing of Government research papers in recognized scientific journals, discouraging unnecessary use of the Government report of scientific research.

3. Support for international activities in publication of international scientific symposia and standards, and of the international effort to improve publication of abstract journals.

4. Subsidy of an adequate effort of translation of non-English scientific papers, unification of translations sponsored by the several agencies, and prompt publication in journals regularly accessioned by the libraries.

5. Immediate initiation of substantial and continuing research on procedures of subject classification, indexing, and retrieval, looking to adequate means of providing to United States and other western scientists full access to the scientific literature of the world.

This program would yield benefits far in excess of the costs involved. It is essential if the United States is to remain scientifically in the front rank.

There are many aspects of the problem, less familiar to me, on which I have not touched in this testimony. Among others, these involve more efficient presentation of the information in new forms and more efficient means of circulating information. A sound and strongly supported research effort on handling scientific information would certainly include such aspects of the problem.

Thank you very much, Mr. Chairman.

Mr. Moss. Thank you, Dr. Berkner.

SECRECY HINDERS SCIENTIFIC PROGRESS

Dr. Berkner, do you think that our present security system is helping or hindering scientific progress?

Dr. Berkner. Mr. Chairman, our present security system is highly mechanical in its operation. It tends to apply the rules of secrecy to a wide range—to a wide variety of categories of information.

In my opinion, much too much information is classified. I would, in my reply, wish to make the point very clearly that there are, of course, some secrets in the field of technology that must always be kept because they are highly important to the safety of the United States.

In a security system which classifies too wide a range of information—particularly much information whose security is not respected because it is available elsewhere—the important secrets tend to be devalued. The important secrets are not kept as well as if there were only a few secrets kept by means of the very rigorous security system that would be possible in a highly selective system.

DECLASSIFY 90 PERCENT OF PRESENT CLASSIFIED MATERIAL

I would hope that eventually more than 90 percent of the present material which is classified could be placed in an unclassified, free category.

Mr. Moss. Do you feel we would actually achieve a greater degree of security in the area where we require it if those changes that you suggest—the declassification of about 90 percent, were to occur?

Dr. BERKNER. I do.

SECURITY COMES FROM PROGRESS

May I at this point refer to my testimony before this committee some years ago on this very point, Mr. Chairman?

Mr. MITCHELL. What page are you referring to, sir?

Dr. BERKNER. In the hearings before the Government Operations Committee of the House which were held on March 7, 8, and 9, 1956. I made the following statement on this point:

I submit that the greatest security comes from progress——

Mr. MITCHELL. What page is that, sir?

Dr. BERKNER. Page 754, the second paragraph of section (D)—

comes from progress, from sound and effective weapons, and men well trained in their tactical use. From an adequate supply of such weapons from a virile industry; from the recognition and public debate of weaknesses so that they can be corrected; from a free and unfettered science and technology that has the power to bring our progress to the vanguard; from a free and imaginative industry that has full access to all knowledge; from allies and friends with whom we deal freely and with a sense of full trust; from a society built on the foundations of mutual confidence upon which free enterprise depends, unfettered by artificial fears of spies and undivided by charges and countercharges, suspicions and accusations.

I would firmly reiterate this statement, Mr. Chairman.

MULTIPLE CLEARANCE

Mr. Moss. Now I would like to discuss for a moment the area of security where the personnel is all cleared and the information classified. We have had in recent months, although it is a restatement of many of the same observations made by the members of the scientific panel in March 1956, much criticism of compartmentalization within the security areas of science.

What are your views on the multiple-clearance system whereby each of the armed services has its own clearance standards?

Dr. BERKNER. This system, of course, represents a serious problem for most scientists because a scientist under the Atomic Energy Commission rules may not be cleared under the rules of the Department of Defense or vice versa. Consequently two scientists who are associated with each agency may find it difficult to talk to one another on matters of vital joint interest.

Certainly a more general clearance procedure would greatly help in communication among scientists.

DANGERS OF OVERALL CLEARANCE SYSTEM

However, there is some danger from an overall clearance system by placing the individual in jeopardy since there would be only one point of appeal within the Government. This must be considered very carefully. It is my opinion, Mr. Chairman, that an effective security system should be founded upon keeping a small body of very essential information secret. Under these circumstances, one can bring security to manageable proportions so that the great majority of information which is really not security information at all can be widely disseminated and so that only a relatively small number of people who can then be very carefully cleared need have access to those few essential secrets upon which our country's safety really depends.

SECURITY SLOWS SCIENTIFIC PROGRESS

Mr. Moss. You have had an opportunity to observe this security system over a period of years. In your judgment has it resulted in a slowdown in the exchange of scientific information, with a resultant lack of progress in research and development?

Dr. BERKNER. Yes, sir; it has and it has the further defect that upon 1 or 2 occasions public mention has been made of certain items which in my opinion should have been kept secret, but which were not kept secret because the devaluation of the security system was too great on account of the tendency to classify too much.

Mr. Moss. Do you think it has added to the cost?

Dr. BERKNER. Immensely.

NEED TO KNOW

Mr. Moss. Inherent in this system is the criterion referred to as "the need to know."

Have you any observations on the practical application of the need-to-know criterion?

Dr. BERKNER. In the development of new weapons or new devices, the criterion of need to know can very severely restrict the provision of information to the Government. It is quite clear that if a device or an idea has not been employed before, that there are no criteria for need to know in the application of that idea or device to some new area of the Government. Consequently, scientists who are in possession of information which might be useful to the Government are not able to determine or perhaps even realize that the information that they have might be useful to the Government in some aspect of defense or other area.

REMARKS OF ASSISTANT DEFENSE SECRETARY NEWBURY

I am reminded, Mr. Chairman, of the statement made to me by a former Assistant Secretary of Defense, Mr. Newbury, who said that the Armed Forces had utterly no interest in seeing the back side of the moon. This was said some months ago.

Of course, we all realize that there is nothing that the Armed Forces want more than to see the back side of the moon for if they can do this,

they are provided with certain techniques imperative to our national defense.

I assume Mr. Newbury was badly informed simply because of the restriction on the flow of information through Government channels to which he should have had access because of his position, but he did not because of these heavy restrictions to normal flow of information.

SECRECY ON BASIC NATURAL LAWS

Mr. Moss. In your opinion, how long can a scientific discovery involving a basic law of nature be kept secret by Government security measures?

Dr. BERKNER. You would probably do this for about 1 year, but because of the parallel development of science in various other areas or countries it would almost certainly be disclosed somewhere else within that time.

DECLASSIFICATION COMMISSION

Mr. Moss. Dr. Berkner, you have indicated that about 90 percent of the material now classified could properly be declassified.

As I recall, that figure was used by at least two other witnesses who have appeared before this subcommittee.

What approach do we use to establish standards for declassification? Do we create some board or commission? Do we need an advisory panel? What procedure would you recommend for declassification?

Dr. BERKNER. It seems to me, Mr. Chairman, that to undertake this job we must first of all set up very rigorous specifications of what should be classified and then by exclusion declassify the balance.

There are a few items in our national storehouse of knowledge that are very clearly items which should be kept secret. I believe the specification of what should be kept secret is far more easy to define than the specifications of what should be declassified.

Mr. Moss. You feel this is a job which could be done.

Dr. BERKNER. Yes, sir.

Mr. Moss. What group is best qualified to do the job?

ADVOCATES COMMISSION

Dr. BERKNER. Since classified information resides in many Government departments it would probably require a special commission having a judicial cast to study the problem, to make specific recommendations on what secrets should be kept and to endeavor to define and restrict these in such a way that the general declassification could proceed rapidly.

DISTANT EARLY WARNING LINE

Mr. Moss. To what extent is basic research being classified by our Government?

Dr. BERKNER. Relatively little, although sometimes in important areas it is classified.

I recall that the communications system that made possible the DEW line in the Arctic was kept classified for about a year and a half and probably delayed the DEW line as a consequence. This should be considered as a result of basic research.

Mr. Moss. Are there other instances you can think of?

Dr. BERKNER. One could undoubtedly define quite a list, but on the whole I think basic research is not widely classified simply because at the time of discovery, few people realized the implications of the discoveries in basic research.

ATOMIC FALLOUT DATA

Mr. Moss. Do you believe information on atomic fallout should be classified?

Dr. BERKNER. A great deal of that information is now available, Mr. Chairman, in unclassified form. Perhaps some additional information could be declassified.

In this area I might point out that what is perhaps needed more than declassification is the assembly of the data in sufficiently concise and pointed form so that they could be more easily understood. In general, technical data such as contained in the Handbook on the Effects of Nuclear Weapons are very complicated and require simplification and interpretation if the public is to understand them. The data in the Effects of Nuclear Weapons, is really very good.

Mr. Moss. Is it adequate?

Dr. BERKNER. I could answer that question better after seeing a real attempt to present the matter in form which the public could understand.

SOLID ROCKET FUELS

Mr. Moss. Should current security classification restricting research on solid rocket fuels be continued?

Dr. BERKNER. In answering that question I might say it has been a source of concern to me that not more research is going on in our universities in the field of solid rocket fuels. I was interested last year to find in Japan that at the University of Tokyo some very good and substantial work on solid fuels was proceeding. To the extent that classification might be interfering with initiation of university research, is a very serious matter that is slowing our progress.

There are undoubtedly some areas of solid rocket fuel research which require continued classification. This should be examined carefully so that the general field could be opened to wider participation by our university scientists.

Mr. Moss. You say there is considerable research going on in Japan on solid rocket fuels. Is information on this research available to our scientists?

Dr. BERKNER. As far as I know the Japanese research is freely available to American scientists. I mention the Japanese rocket fuel research only because I feel more research of this kind should be proceeding in American universities.

EFFECT OF SECURITY ON EDUCATION

Mr. Moss. What is the effect of Government security on teaching in the universities? Are our universities using the latest scientific information in instructing the scientists of tomorrow?

Dr. Berkner. As I said earlier, on basic research the classification is relatively light at the moment, but the classification of technical development is of the greatest import.

In the field of engineering, classification has a substantial influence, in my opinion, on the availability of material for handbooks and textbooks.

The Atomic Energy Commission, however, has moved very substantially in the last year or two to release some of the basic information concerning reactor configuration and design, and these materials have now been assembled in handbooks which are rather useful. If more of this could be done it would be most helpful.

PRESIDENT'S PROPOSAL

Mr. Moss. We have the recommendation of President Eisenhower in his state of the Union message calling for action by Congress to make more scientific information available, or to bring about a greater exchange with our allies. (See exhibit I.) Do you believe we should share more scientific information with our allies?

Dr. Berkner. Yes, sir. In Great Britain, for example, we have many thousands of scientists who in many cases are carrying on work which parallels research which is going on or has already been done in the United States. Since we could progress more rapidly in the west by pooling our efforts, these very good British scientists could be carrying on work not duplicating ours but advancing the general western position with respect to science. Freedom to interchange information with our allies would make possible the employment of these scientists for our own as well as their own benefit. Quite aside from this there would seem to me to be many military advantages in the field of training and operations which free interchange of information with our allies would make possible.

Mr. Hoffman. Going back over your last question, where you referred to the scientists in Great Britain and spoke about, as I understood, working with them——

DUPLICATION OF EFFORT

Dr. Berkner. Mr. Hoffman, if we could exchange information freely between the United States and Great Britain, it would not be necessary for the British to spade over the same ground that we already have been over or may be going over at the moment. Consequently, the scientific manpower of both countries would be available for more advanced scientific projects, since the duplication would have been eliminated.

Mr. Hoffman. That is, if our scientists had answered a particular question, you would give the British the benefit of that?

Dr. Berkner. Yes, sir.

Mr. HOFFMAN. But you wouldn't destroy competition, would you, by any means, between scientists?

Dr. BERKNER. The competition should be of the form simply of checking results and acquiring skill in a particular new scientific technique. Certainly we would allow any scientist to proceed as he would, but it is very unlikely that he would repeat an experiment, perhaps at every great cost, in which he was confident that we had already obtained the correct solution.

Mr. HOFFMAN. Yes, but on questions that have not been solved—for example, I think it was yesterday, I read about the medical scientists who were trying for a cure of cancer. They can cure some cancers. If you tell the other scientists about that, you would make that knowledge common, but you wouldn't make any suggestion that they shouldn't try other ways of extending their knowledge?

Dr. BERKNER. No, sir. I would agree that competition, where knowledge has not yet been found, is of the greatest essence.

Mr. HOFFMAN. And sometimes where they thought they had found a fairly satisfactory answer, they might still continue?

Dr. BERKNER. You need checking of results and the development of skills.

Mr. HOFFMAN. Several remedies lately or in the last few years have been advanced for one thing or another. They tried them awhile and then they discovered that they weren't what they were supposed to be. You wouldn't put any strings on research at all, would you?

Dr. BERKNER. No, sir. Quite aside from that, one often does experiments someone else has done simply to acquire the skill that is necessary to do the experiment so that you can go on from that point.

Mr. HOFFMAN. And then I understood you to express the thought that we might have a better system of indexing and making available the information we had, that the scientists had—are you familiar with the way we get our law, that is, through common law and statutes and court decisions?

Dr. BERKNER. The lawyers have one great advantage: they are all trained pretty much in the same professional language, and they use that professional language to approach the questions of law.

Mr. HOFFMAN. Well, the judges don't, do they? I am thinking of recent decisions. You might well take another look at this idea they are using the same language. They certainly reach different conclusions.

Dr. BERKNER. Without regard to the conclusions, in science where we have a very broad range of sciences, extending from medicine on oen hand to physics on the other, a scientist in medicine may write a paper which will turn out to be important to the physicist. In the many hundreds of thousands of scientific papers, the physicist is unlikely to know of the medical paper which should influence his work unless some method of indexing is found which would permit the physicist to automatically get access to a paper in medicine in which he had interest.

Mr. HOFFMAN. I had in mind that idea of making information more available, and that is why I referred to law and laws.

You are familiar with the fact, for example, that the West Publishing Co. could fill that whole side of the room there with digests and

indexes. There are the publications of the Lawyers' Reports, Annotated, American Jurisprudence, and so forth. No lawyer, as far as I know, has ever been satisfied with them because he couldn't put his finger on what he wanted. He didn't know where to look. But couldn't that be done with scientific information?

Dr. BERKNER. I would hope so. It hasn't at the moment.

Mr. HOFFMAN. The reason it hasn't been effectively done, I gather, is because it hasn't been profitable and the funds weren't available.

Dr. BERKNER. That is correct.

Mr. HOFFMAN. Is it your suggestion that the Government undertake the setting up of an agency to digest and public scientific information?

Dr. BERKNER. I would suggest that we do the research necessary to find out how such a system can be set up, first of all.

Mr. HOFFMAN. Would it be all right to consult some of these makers of legal digests?

Dr. BERKNER. I think it would be very fine.

Mr. HOFFMAN. I do, too.

What do you say, Dante?

Mr. FASCELL. Absolutely.

Mr. HOFFMAN. Because they cross-index it—sometimes they say, "See another subject," but usually they cross-index it so ultimately that you can find it if you have patience.

Dr. BERKNER. What I would call a multiple-coordinate system.

Mr. FASCELL. You mean touch as many points as possible?

Dr. BERKNER. That is right.

Mr. HOFFMAN. It is not difficult at all to understand your criticisms.

What would you suggest as to classification? Who should, in your opinion, be charged with the duty of classifying information?

INDEX CLASSIFICATION STUDY SUGGESTED

Dr. BERKNER. In my opinion, Mr. Congressman, I would supply to the National Science Foundation sufficient money to establish a really broad-scale research project to study legal methods, among others, to study the whole method of subject classification and indexing.

I think it would be very dangerous to go off the deep end by adopting an untried system, because such an untried system might not lend itself to electronic computers or other methods for the searching for information.

I think trials must be made in order that the system can be gradually extended. Such research certainly would be most useful in bringing our subject classification up to date and in developing methods for retrieval that could make quite certain access to the relevant material.

CLASSIFICATION SYSTEM

Mr. HOFFMAN. What you are saying is that we take another look at it and find some way of doing it.

At the present time I understand the Government officials say whether a paper is classified and how.

What would you substitute, if anything, in place of that?

Dr. BERKNER. I misunderstood your word "classification." I thought you were speaking of subject classification, and I take it you are referring to security classification.

Mr. HOFFMAN. Yes, I was. Pardon me for not making it clear.

ESPIONAGE ACT

Dr. BERKNER. I sometimes get confused on the word "classification," also. The word can be applied 3 or 4 ways.

In the case of security classification, the difficulty is as follows: We go back to the basic espionage act, which——

Mr. HOFFMAN. Let me interrupt you right there, if I may. Weren't you talking previously of security classification?

Dr. BERKNER. I was speaking of subject classification.

Mr. HOFFMAN. In your paper, here?

Dr. BERKNER. In my paper I was speaking of subject classification.

Mr. HOFFMAN. That I don't know anything about.

Now, we get over to the security end of it, where I maybe know less.

PENALTIES OF SECURITY SYSTEM

Dr. BERKNER. Each person in the Government and in fact many outside have the responsibility of stamping security on any item that conceivably might have an effect on the security of the United States, from the point of view of the security of information. There is no encouragement for him to keep the matters unclassified.

Let me say it this way: If he were to fail to stamp something secret that later some official ruled should be secret, he would be to blame.

Mr. HOFFMAN. He would get a penalty from somewhere.

Dr. BERKNER. He would be penalized. But there is no penalty for stamping something secret which shouldn't by kept secret.

Mr. HOFFMAN. How would you remedy that?

Dr. BERKNER. By defining very sharply the material that should be kept secret.

Mr. HOFFMAN. Would you define that? Suppose I wanted to introduce a bill that will get me some publicity, and also incidentally serve the Government. Your definition would be very, very helpful.

Dr. BERKNER. I am afraid if I tried to define this off the cuff, I probably would violate security regulations, Mr. Congressman.

Mr. HOFFMAN. Violate what?

Dr. BERKNER. Security regulations.

Mr. HOFFMAN. Oh, no, no; you don't need to do it here, but tomorrow or within a week, send me up a little statement as to how information should be classified or declassified, and stamped "Top Secret", "Secret", "Confidential", and anything else that may occur to anyone.

You see, it is a practical question, and I am just assuming that the folks in the Department down here, presumably the Eisenhower administration, but in reality the holdovers from the years back—they aren't doing this job as they should. And I admit it probably isn't perfect.

Now, just what can we do, how and in what language? That is what the chairman and the committee, as I understand it, has been seeking for a good many years.

DEFINING CLASSIFIED SUBJECTS

Dr. BERKNER. This I think could be done by administrative regulation—by defining within the Government certain specific items and specifying that these items will be kept classified.

Mr. HOFFMAN. That is what I want; which items?

Dr. BERKNER. If I were to tell you what the secrets of the United States were, then I would be in trouble.

Mr. HOFFMAN. Oh, no.

Dr. BERKNER. But the administration can define to its own departments——

Mr. HOFFMAN. Well, it has, but Congress doesn't like it, and the newspapers don't like it.

Dr. BERKNER. Well, I believe that these are defined very generally, but not specifically, and with much delegated authority to classify as the Department or individual chooses.

Mr. HOFFMAN. You aren't a bit of help to me, don't you see, on that one? I am not critical about it. I didn't expect you would have an answer.

Dr. BERKNER. I have, but the difficulty I have is: if we discuss it openly——

CONGRESS' NEED TO KNOW

Mr. HOFFMAN. I have a need to know. Congress has a need to know how to more accurately, more efficiently define this security test or outline this security test.

Now, you are an expert on it——

Dr. BERKNER. There are certain specific items in our storehouse of knowledge which affect the security of the United States.

Mr. HOFFMAN. What are those?

Dr. BERKNER. When I say "specific items," I can't name these items because they are already classified very highly, and they properly should be.

Mr. HOFFMAN. You think that so far the administration is all right?

Dr. BERKNER. Yes, sir.

TRANSLATIONS CLASSIFIED

Mr. HOFFMAN. Now, which ones are they wrong on?

Dr. BERKNER. On a great many items beyond these.

Mr. HOFFMAN. Could you give us a general statement?

Dr. BERKNER. Surely, these translations that are being classified at the present time.

Mr. HOFFMAN. That may be due to lack of funds.

Dr. BERKNER. No, no, there are some translations being made today but stamped "Confidential" or "Secret."

Mr. HOFFMAN. Do you mean after they get them out?

Dr. BERKNER. After they are translated.

Mr. MITCHELL. From another language?

Dr. BERKNER. From another language.

Mr. HOFFMAN. That is to say where other people know about them and put it in their language—I can go along with you on that. Even if I can't understand a fellow when he talks about it, I have no objection to hearing it.

Now, with reference to this translation item, you are familiar with the rumor, or assertion, that the taxpayer works 4 months of the year or a third of the year to pay his taxes?

Dr. BERKNER. Yes, sir.

Mr. HOFFMAN. Let us assume there is some semblance of truth in that.

Now, do you think we should, in order to get this scientific information together, either cut something else, and if so, what, or impose another month's work on him?

Dr. BERKNER. I wouldn't suggest cutting anything else.

Mr. HOFFMAN. You wouldn't suggest anything? I mean domestic legislation?

COST OF RESEARCH

Dr. BERKNER. I would point out, Mr. Hoffman, that the top half of the national income today essentially supplies all of the income tax and that makes the funds available to the Public Treasury, comes from the research and development that has been done since the turn of the century. There would not be enough moneys coming into the Public Treasury at the present time without it. Research provides the capital which is producing the income to the Federal Government. By failing to do those things which can further increase the revenue to the Federal Government, we are depriving the taxpayer of an opportunity to have his taxes cut.

Mr. HOFFMAN. That is to say more money would come in from your work?

Dr. BERKNER. That is correct.

Mr. HOFFMAN. I don't think there is any doubt about that. That has been demonstrated time and time again.

Mr. MOSS. Would you yield at that point?

Mr. HOFFMAN. Yes.

AVAILABILITY OF ABSTRACTS

Mr. MOSS. Isn't it true that the ready availability of abstracts of translations might well avoid costly duplication of effort in this country?

Dr. BERKNER. Yes, sir.

Mr. MOSS. And the overall effect could well be a reduction in cost to Government and to the private research undertaken in the United States?

SOVIET RESEARCH EFFORT

Dr. BERKNER. Mr. Chairman, I noticed last year the Soviet Union appropriated $4.5 billion for scientific and technological research and development. This figure I believe was announced at the time the budget for the Soviet Union was published a few months ago. That represents a very large-scale activity. Obviously much if it will be research that we are not doing at this moment. To the extent that we can have access to this research and make available the information to our scientists, to that extent it can substitute for money that we would have to spend ourselves to accomplish the same results.

It is very unlikely that a complete availability of Soviet information would cost more than a very tiny fraction of the expenditure that

they are making. It is for this reason I believe, among others, that the Soviet Union is spending very large sums of money translating and making our scientific literature available to Soviet scientists.

Mr. HOFFMAN. I think we all agree that scientific research has resulted in increased production and all of the other things that we like, but the sad fact remains that still the demands for funds increase all the time, and in spite of those contributions made by industry and scientists, we don't get around to where we balance the budget.

Now you spoke about the Soviet Union—$4 billion, I think, for scientific research?

Dr. BERKNER. $4.5 billion.

Mr. HOFFMAN. They didn't send 50 or 60 billion dollars to other countries for foreign aid, did they?

Dr. BERKNER. I am not an expert in that field.

Mr. HOFFMAN. I don't find anything that says they did, and I don't recall that they had any expenditures for veterans' benefits or for social security. They seem to have skipped all those things that our people like.

And so if we have to—and I am not saying we shouldn't—appropriate additional funds for scientific research, and so on, as you suggest, what proportion of our taxpayers' time would you suggest be used to get that money?

Dr. BERKNER. With regard to foreign aid, I might say that I was in India last year and I thought the Soviets were doing a pretty good job on foreign aid in India.

Mr. HOFFMAN. That depends on how it turns out, of course.

Dr. BERKNER. The point I would make is that investment in scientific research and in making that information available is of course a form of investment to produce larger income——

Mr. HOFFMAN. That is something I do not question. I am just asking how much more of the taxpayers' time would you think should be devoted toward earning the money necessary for that improvement?

UNITED STATES RESEARCH EFFORT

Dr. BERKNER. Let me put it this way, sir: The appropriations for science under the National Science Foundation last year were approximately $20 million. The appropriations for the Department of Defense for fundamental research were about $30 million. The national expenditure for chewing gum was $280 million.

Now I think we should try to measure the research effort that we are making in terms of something we can understand, and I really think that the extent of research supported by agencies as great as the Science Foundation and the Department of Defense should approach the amount of money we spend for chewing gum.

Mr. HOFFMAN. Or soft drinks. To what individual or group of individuals would you entrust the duty of determining what should be classified and the degree of classification?

DECLASSIFICATION COMMISSION

Dr. BERKNER. Mr. Congressman, I would suggest that there be appointed a Government commission with a judicial cast to look at the matter of security——

Mr. HOFFMAN. Pardon me. What do you mean by "judicial cast"?

Dr. BERKNER. In the position of judging the relative advantages of progress on the one hand with respect to the protection of a secret on the other; to look at the problem of security broadly, and to make recommendations to the President with regard to changes in security regulations so that we can have more progress and less blocking of information.

What I am afraid of is that some day we may have to fight a war with pieces of paper marked "secret" rather than weapons and men who are ready to fight.

Mr. HOFFMAN. Then as I get it you would have another commission?

Dr. BERKNER. Yes, sir.

Mr. HOFFMAN. You don't know what the number of that one would be, do you? I mean not the number in the commission but the number of the commission, itself?

Dr. BERKNER. It would save us a lot of money.

Mr. HOFFMAN. In my experience, here—for example, take the merchant marine, we found the merchant marine giving away, on one occasion as I recall, $25 million worth of ships. I believe at that time it was a commission. We abolished the commission and appointed an administrator. The next time something went wrong, as it did in the merchant marine business, we kicked the administrator out and appointed a commission.

Do you remember, Mr. Moss, or weren't you here?

Mr. Moss. I wasn't here at the time.

Mr. HOFFMAN. It just seems to me that that is what we do all the time, and we don't really get anywhere.

I would like to see some progress made on this classification subject if it can be made, other than to leave it to the executive officials, giving them the benefit of our criticism all the time, and faultfinding.

All you come up with is another commission?

NO MOTIVE TO DECLASSIFY

Dr. BERKNER. It is my feeling in any event that rules must come out which force an official who classifies a document to weigh the matter to determine whether the greatest security of the United States would come from declassification and progress, or from classification to secrecy. At the moment there is no motivation upon the official who classifies a document to weight it in this way. He can only be put in jail for one thing, and that is for disclosing information.

Mr. HOFFMAN. Would you amend the statute or the Code (5 U. S. C. 22)?

Dr. BERKNER. I think this is best done by administrative regulation.

Mr. HOFFMAN. Not by amendment to the statute?

Dr. BERKNER. I think it would be very difficult to amend the statute.

Mr. HOFFMAN. I do, too.

Mr. MITCHELL. Do you believe that these members you are referring to should be made up of the scientific community who have a knowledge in this particular field or should they be security-minded officials?

SHOULD HAVE REPRESENTATIVE MEMBERSHIP

Dr. BERKNER. I think, Mr. Mitchell, that the members should be from various areas of American life. Perhaps a member from business, a member from the academic profession, a member from the scientific profession, certainly from the legal profession. It should represent various segments of American life so that different views on the basic judgment of that should or should not be declassified could be expressed.

Mr. HOFFMAN. I want to thank you, Doctor, for your patience and consideration.

That is all, Mr. Moss.

Mr. Moss. Mr. Fascell?

Mr. FASCELL. I would like to continue on that line of questioning for a moment, Doctor.

Even if you had a cross section of American experience and opinion, wouldn't the ultimate decision rest on two classifications: one scientific and the other military?

Dr. BERKNER. Well, sir, I think American business has much at stake in this.

Mr. FASCELL. There is no question about that.

Dr. BERKNER. And business, itself, could demonstrate what it could do if certain information were available.

Mr. FASCELL. And this would be a factor in the determination of whether or not the particular material ought to be classified for security purposes?

Dr. BERKNER. Yes, sir. I point out that there is more than the security of information. There is the security of progress which is, after all, more important.

Mr. FASCELL. In other words, a piece of scientific information could contribute more to the economic security of the country than it could to military security?

DEW LINE DELAYED

Dr. BERKNER. Even more to military security.

I recall that as late as a year after the communications system that was developed for the Arctic had been tested, that top military authorities were still not aware of it because of classification. This probably delayed our military security by some time.

Mr. FASCELL. Now, the National Science Foundation is not the type of instrument you envison to do this job?

DECLASSIFICATION AFFECTS MUCH OF NATION

Dr. BERKNER. No, sir. I think it would be wrong to assign this job to scientists alone. I think it affects many elements of American life.

Mr. FASCELL. At the present time is it being assigned to the military alone, in most cases?

Dr. BERKNER. It is being assigned really to any citizen of Government official or employee who has any question as to whether a piece of information might be security information from the present legal point of view.

Mr. FASCELL. And his attitude would be simply to protect himself and classify it, if there is any doubt about it at all?

Dr. BERKNER. Yes, sir. It is the only motivation that is involved.

CLASSIFICATION OF UNCLASSIFIED MATERIAL

Mr. FASCELL. I am inclined to agree with you.

Now, getting back to this problem of translation, you say that we have some Government agencies making translations of open foreign scientific literature but restricting circulation by security classification.

Would you identify some of those agencies for us?

Dr. BERKNER. I am raising the question in my mind as to whether the names of those agencies would be classified information. It is quite evident that by classifying the information, they do not wish to disclose their identity. Therefore, if I were to disclose that identity, I would probably be violating security regulations.

THE SECRET AGENCIES

Mr. FASCELL. In other words, we have a secret Government agency making a translation of an open scientific document; but, because it is a secret agency, it becomes necessary to classify the document to show that the secret agency didn't translate the open document?

Dr. BERKNER. Yes sir.

I could provide basic information which would permit your counsel to investigate this and determine what information could be made available to the committee.

Mr. Moss. I think we should do that.

Mr. FASCELL. By all means, Mr. Chairman.

I guess we should have known that we had agencies that were so secret we couldn't name them.

PAPER TRANSLATED SEVEN TIMES

Mr. FASCELL. With regard to duplication of effort, you were talking about a document, I believe, that had been translated seven different times.

Dr. BERKNER. Yes, sir.

Mr. FASCELL. Will you identify the document?

Dr. BERKNER. I believe it was a Russian paper in the field of hydrodynamics. I don't have the name of the paper with me, Mr. Fascell, but I could identify it precisely.

Mr. FASCELL. Are you familiar with the agencies which made this translation?

Dr. BERKNER. One or two of them, yes, sir.

Mr. FASCELL. Could you name them?

Dr. BERKNER. Since the translations were classified, I will resort to my original answer. I think it would be divulging classified information to identify them.

Mr. FASCELL. We have just declassified something because that tells us we have seven secret agencies. Their names per se are not secret or classified?

Dr. BERKNER. But the information that they were translating Soviet material would be classified.

MULTIPLE COORDINATES

Mr. MITCHELL. Dr. Berkner, you referred to this multiple-coordinate system which you believe should be established.

Could you, for the benefit of the committee, give us an illustration of multiple coordinates?

Dr. BERKNER. Yes, sir. Very recently a member of our chemistry department had the need for a certain type of pump. It turned out that this pump had already been devised by medical people for aid in the circulation of blood. The pump devised in the field of medicine was very suitable for his work in the field of chemistry.

NEED FOR WIDER REFERENCES

Now, it is very unlikely in the present system of the exchange of information that the medical paper would have been found by the chemist if someone in the field of medicine who knew about this pump and also knew the chemist was not available to tell him about it. To have devised this pump would have meant months of research on the part of the chemist, but since it was already available from the field of medicine, it could be immediately adapted to the chemical purpose.

This is only one of perhaps a great number of examples in which means are needed to go from the language of one science into another science to provide access to special information which that second science has developed.

Mr. MITCHELL. In your prepared statement you said that such a system has not as yet been perfected in the western world?

Dr. BERKNER. Yes, sir.

Mr. FASCELL. Is that an inference that it has been perfected some place else?

ALL-UNION'S EFFORTS

Dr. BERKNER. The Soviet Institute of Scientific Information is working very hard in this field at the present time. They have a very large group of people working in the field.

Mr. MITCHELL. What would be the effect to the country that develops an adequate multiple-coordinate system?

Dr. BERKNER. It would be enormous. It would not only reduce the duplication of research, it would not only make available to an individual the full background of scientific work that had been done on any subject on which he wanted to work, but it would provide opportunity for synthesizing a wide range of information from a number of sciences in the solution of any particular problem.

Mr. MITCHELL. Would this system force scientific journals and papers from all over the world into it?

Dr. BERKNER. Yes, sir.

PROJECT SHOULD BE ORGANIZED

Mr. MITCHELL. Have you any recommendations to make to the subcommittee on how such a project could be started within Government, or by a combination of Government and private enterprise?

Dr. BERKNER. I would urge that the National Science Foundation be given sufficient research funds to set up a very widespread project to investigate the methods of subject classification and methods of retrieval and perhaps, as well, improvement of the presentation of scientific information.

Mr. MITCHELL. Do you believe that this project should be started immediately?

Dr. BERKNER. I do.

Mr. MITCHELL. How do the other members in the scientific field feel on this subject? Do you know from your personal knowledge?

INTERNATIONAL CONFERENCE CALLED

Dr. BERKNER. I believe there would be very strong support of it. I had the honor of attending a conference at the National Academy of Sciences last fall where plans were being laid for an international conference on scientific documentation. At that time there was expressed a very widespread feeling throughout science for the need for urgent improvement of our methods of subject classification and of retrieval, and for support of research needed to develop an adequate system.

Mr. MITCHELL. If a German or British scientist attempted to have a paper published in a recognized scientific journal in America, could you give us an illustration of the difficulties imposed on him?

PAGE CHARGES

Dr. BERKNER. Well, sir, at the present time most American scientific journals have to make page charges. As I recall it, the page charge for the American Physical Review is $25 per page, in an endeavor to stay solvent.

Mr. MITCHELL. Who pays that?

Dr. BERKNER. This has to be paid by the author or by the organization that supports the author.

If an English scientist were to endeavor to publish this paper he would not, of course, have access to the funds necessary to publish it in the American journal because of restrictions on exchange. Consequently, the journal would either have to waive the charges (and extensive waiving of charges would cause the journal to go broke) or they would have to refuse the paper.

USE OF COUNTERPART FUNDS

Mr. MITCHELL. Could the counterpart funds which we have scattered throughout the world be effectively utilized in this area?

Dr. BERKNER. Yes, sir; this would be an excellent use of counterpart funds, since it would bring the publication of scientific material to the United States, to American journals.

Mr. MITCHELL. Do you know whether or not counterpart funds have been made available for scientific meetings in other countries for the use of our American scientists?

Dr. BERKNER. They may have been made available, but not to my knowledge.

MACHINE TRANSLATIONS

Mr. MITCHELL. To establish this project in the field of multiple-coordinate systems, would it also entail the so-called machine translation of scientific documents?

Dr. BERKNER. This might very well be involved. I have no direct knowledge of this, but I have heard that the Russians have pressed an English-Russian translation system very hard. I have some doubts as to whether this has been successful because of the complexity which I know exists in the translation of English to Russian, but I might add that this complexity is even greater in the translation of Russian to English. Nevertheless, some modestly successful attempts have been made in machine translation, and this is sufficiently promising to be worthy of much more careful examination.

Mr. MITCHELL. Do you believe that some agency in our Government should be aware of all the projects going on in this field of machine translation?

Dr. BERKNER. Yes, sir. I should think it would be a very important matter.

I would say this: At the moment I doubt if a machine translation could be substituted in the field of scientific literature for normal methods of translation, and I think one must continue to resort to normal methods for some time to come. Machine translation is, however, very worthy of further research.

RUSSIAN PREDICTIONS

Mr. MITCHELL. Are you aware of rumors that the Soviets have already announced that they intend to have such a machine available in the fall of 1958?

Dr. BERKNER. I have heard a rumor to this effect, but I have no way of knowing whether this is correct.

Mr. MOSS. Dr. Berkner, I have one other question I would like to ask. It seeks an expression of opinion from you:

SOVIET ACHIEVEMENTS WRONGLY QUESTIONED

There is a strong impression in the American mind that the Soviet attainments in atomic fission is primarily the result of espionage and that Russian advances in rocketry are primarily due to captured German rocket experts.

What is your opinion on these commonly-held beliefs?

Dr. BERKNER. Mr. Chairman, I believe that these are substantially incorrect. It is quite impossible to achieve a very complex development such as the present Russian rocket developments or developments in the field of nuclear science without a long history of education and training of a very large number of people, without careful research on their own part, and without a widespread understanding of the processes involved.

It is true that espionage might provide them with some small help if they already have the organization and the facilities to do the job. But the espionage by itself could not possibly give them sufficient information and skill to adapt their own processes and their own

materials to the successful utilization of these items without full and deep understanding of the processes in advance, themselves.

Mr. Moss. You feel it would be a mistake for us to continue to attribute the progress Soviet science has made to outside factors?

SIGNS OF PROGRESS

Dr. BERKNER. I point out to you, sir, that their first atomic bomb followed ours by some years. Their hydrogen bomb followed ours by about 1 year. Their satellite preceded ours by some amount that we do not yet know. This indicates a background of very strong scientific and technical training and support for research over a period of years that is now beginning to pay them handsome dividends.

Mr. MITCHELL. On page 9 of your prepared statement you referred to the fact that many colleges and universities might perform scientific research for the Government which is never published.

Could you explain more fully to the subcommittee what is meant by that statement and its effect on science? It reads:

> The Federal Government can do much to aid. At the moment, Government agencies refuse to pay charges levied for the publication of scientific research done under their sponsorship.

COMPTROLLER GENERAL'S RULING

Dr. BERKNER. That is correct. I meant by this publication in the normal scientific literature, the journals of the societies, or other journals imposing page charges in order to finance the publication. Many Government agencies insist that either under law or under ruling of the Comptroller General that they cannot pay such charges and they use this as a basis for not publishing in the regular scientific literature.

Mr. MITCHELL. Thank you, sir.

Mr. HOFFMAN. It might be well to omit some material from the Congressional Record and put in some of these scientific papers. Of course, it wouldn't be in the customary form but it would be in there. I mean it would be available.

JOURNAL OF SCIENTIFIC RESEARCH PRAISED

Dr. BERKNER. I know of no scientific papers in the Congressional Record, but I must say that the Superintendent of Documents does publish 1 or 2 regularly accessible scientific journals that are pretty good. The Bureau of Standards' Journal of Scientific Research is one that I know of, and it is considered very good.

Mr. HOFFMAN. You wouldn't say some of the material that goes into the Congressional Record, including the appendix, might be omitted?

Dr. BERKNER. I haven't read all of it.

Mr. Moss. Dr. Berkner, I want to thank you for taking your very valuable time to appear here and aid the subcommittee in its study of this problem of availability of information. Your very excellent statement answers a great many of the questions which I had prepared in advance, and it is not going to be necessary for me to specifically seek the answers to those questions.

I hope that as we continue our study, we will be able to call on you for further advice and assistance.

Dr. BERKNER. Thank you, Mr. Chairman. I am very happy to have been of assistance to the committee, and I hope I can continue to be so.

Mr. HOFFMAN. I want to thank the Doctor, too, for the help he has given me and for the very frank admission that we need another commission to solve a question which he is not prepared to suggest the answer to at the moment.

Dr. BERKNER. I am very happy to have been helpful.

Mr. HOFFMAN. We appreciate your degree of modesty.

SCIENCE ATTACHÉ PROGRAM

Mr. MOSS. I would also like to congratulate you on the part you played in restablishing the scientific attaché program. You called it to the attention of this committee, and I know you were the principal force in bringing the program about originally.

Dr. BERKNER. Thank you, Mr. Chairman.

I may say that I believe that with the reestablished scientific attaché program, that the program can be of great assistance in the exchange of foreign scientific information with the areas of the United States.

Mr. MOSS. Thank you, sir.

We will break for about 2 minutes, and then resume with Dr. Hughes.

(Whereupon, a short recess was taken, at the conclusion of which the following occurred:)

Mr. MOSS. The subcommittee will now come to order.

We are very pleased to hear from Dr. Donald Hughes, senior physicist at Brookhaven National Laboratory and former chairman of the Federation of American Scientists. Dr. Hughes was very helpful on the scientific panel which appeared before the subcommittee in March 1956.

Dr. Hughes.

STATEMENT OF DONALD J. HUGHES, SENIOR PHYSICIST, BROOKHAVEN NATIONAL LABORATORY

Dr. HUGHES. I am Donald J. Hughes, senior physicist at the Brookhaven National Laboratory.

I appear here not as a representative of the laboratory but as an American scientist concerned about the future of my country. I am active in the basic-research field of nuclear physics, in particular with the study of the interaction of neutrons with matter. This work has resulted in many contacts with Soviet science; during last July I visited Russia at the invitation of the Soviet Academy to lecture and consult in the field of nuclear physics.

In my testimony this morning I shall consider the problems involved in the flow of information in science and technology. However, I would like to begin with this prepared statement concerning the importance of scientific information at the present time.

INFORMATION VITAL TO SURVIVAL

Because of the intimate relationship of the many branches of basic research to each other, it is vital that scientists have ready access to the great range of technical literature with a minimum delay. Because of the importance of research to later military developments, the flow of information, which is vital to the development of basic science, has a direct bearing on the actual survival of our Nation.

Science is becoming an ever more important aspect of our life and it is certain that this trend will not only continue but accelerate.

In the present struggle with the Soviet Union there is no doubt that the immediate urgency concerns military might, the availability and potency of such things as bombers, submarines, missiles, and nuclear weapons. However, if we look beyond the immediate future, we must realize that in the long pull the development of basic science has the greatest importance. It is essential that we do not confuse basic research with tha applications that follow from it. Development of an atomic icebreaker, a sputnik, or a large atomic powerplant is not basic research. Such projects are the practical applications of basic research, and, of course, they cannot take place without it. In our present concern for the future we must not forget the distinctive needs of basic research; for example, freedom of inquiry, as compared with development work, in which strongly directed, programmatic work of a crash nature is possible.

SOVIETS HAVE BROAD PROGRAM

Recent events have shown that the Soviet Union is applying great effort in both aspects; specific applied projects of military and propaganda importance are being pushed as crash programs—at the same time extensive developments are being made to build up basic research, at the present time largely by means of intense science education. The launching of sputniks, the startup of the world's first atomic powerplant, and the building of the world's particle accelerator are all development projects, pushed with the highest urgency. At the same time extreme emphasis is being placed on scientific education, with a number of incentives and controls to insure that the top brains are put to work in science. There is very little freedom of action on the part of individuals in all of these activities, for they are carried out in typical dictatorial style.

DANGERS OF COPYING METHODS

The grave danger to the United States is that we may attempt to outdo the Russians at their own game, by a slavish imitation of their accomplishments. Actually, the entire Soviet system is made up of crash programs and as a result there is little chance for individual liberty and a reasonable standard of living. It is our problem to meet the Soviet challenge both in military might and in the basic science that is essential to all future technical developments without resorting to the methods of dictatorship. It is true that at times we shall need crash programs, as we did when the atomic bomb was developed so rapidly, but we must realize that the progress of basic research is not something that can be crashed.

UNITED STATES STILL AHEAD

Although at the present time we are still ahead of the Soviet Union in most fields of basic research, this fact should give rise to no complacency; the extensive training of science students in the Soviet Union, the high quality of the course work, and the high priority given to scientific development post a danger that our lead can be short lived. In my opinion, the steps of the most importance that must now be taken are:

HUGHES RECOMMENDATIONS

1. Science education must be greatly extended in numbers and improved in quality, particularly in the secondary schools. The students best able to perform creative research should be given every opportunity to become scientists.

2. The support of basic research must be increased not only in terms of money, which should come from the Government and industry, but in the understanding of the nature of basic research itself. There must be no attempt to dictate the course of basic research from above, and continuity and freedom of inquiry must be strongly protected.

FLOW OF INFORMATION SHOULD INCREASE

3. All aspects of the flow of technical information, which your committee is wisely studying, must be thoroughly investigated and improved. The matters of greatest urgency are the ready availability of the world's scientific literature to all workers and a reduction of information security to the absolute minimum. It must be realized that secrecy always impedes research and that it should be imposed only when grave danger would follow from disclosure.

Mr. Moss. Dr. Hughes, I notice in your first paragraph you tell us of a visit to Russia during July of last year, at the invitation of the Soviet Academy.

I wonder if you would care to tell us what you observed during that visit.

VISIT TO RUSSIA DESCRIBED

Dr. HUGHES. I observed many things. I won't be able to describe all of them, but I can explain very briefly why the visit was arranged, and maybe you could question in more detail.

I was invited by the Polish Academy of Science and by the Soviet Academy of Science to give lectures, to visit laboratories, and to consult with their scientists, as the invitation worded it, to consult about progress and problems.

Actually, I had a very busy program. I was behind the Iron Curtain for 1 month, about half the time in Poland, about half the time in Russia, and during that time visited very many laboratories, gave a large number of lectures, and talked probably to hundreds of individual scientists.

Mr. Moss. Did you find this of value to you?

Dr. HUGHES. I found it of great value to me, I think, mainly in increasing my understanding of what science is like in the Soviet Union.

If I may give you a frank answer, it did not help me by a large amount technically, and I think the reason is in the field of nuclear physics, the Soviet Union is definitely behind us.

THE ALL-UNION INSTITUTE

Mr. MITCHELL. Did you have any occasion to learn about the All-Union Institute?

Dr. HUGHES. I had quite a few occasions when I learned about the Soviet institute.

Actually, I talked for about 3 hours with Shikanov, who is the director of the institute. I also talked to many of the individual Soviet scientists about how the institute affected them in their own work, so I think I got a good knowledge of the institute.

Mr. MITCHELL. Could you explain to the subcommittee how well this institute is performing and whether there are any deficiencies that you observed?

DESCRIPTION OF ACTIVITIES

Dr. HUGHES. The Soviet All-Union Institute was formed in 1953. That is one important thing to remember, because projects like this take a long time to get running well. In spite of the fact, however, that this institute has been underway for only 4 years, it is performing a tremendous job in abstracting and translating technical literature at the present time. One of the Soviet scientists, Nikitin, told me, for example, that in the abstracting service of this institute there appears something like 600 abstracts in nuclear physics alone, each month. You can imagine the problem of an individual scientist trying to keep up with 600 articles if there were no abstracting service. This would mean reading 30 articles every day. It is a big job that they are accomplishing.

Mr. MITCHELL. Is their abstracting service better than the comparable ones in this country?

COMPARISON WITH UNITED STATES ABSTRACTING

Dr. HUGHES. That is difficult to say. There is no abstracting service that is comparable. I think that is really the answer. We have no centralized abstracting service that covers all technical literature the way the All-Union Institute does. We have no abstracting service even in physics which would cover 600 articles each month. We have nothing that is comparable to the magnitude of this Soviet institute.

Mr. MITCHELL. Dr. Berkner stated this morning there was a considerable lag of between a year to 4 years in getting the abstracts to our scientists.

Is that the same in the Soviet Union?

SPEED IN ABSTRACTING

Dr. HUGHES. The abstracting service in the Soviet Union requires—in the field I know best, nuclear physics—about 9 or 10 months; that is, a Soviet scientist gets an abstract of an article in his hands 9 or 10 months after that article has appeared in the open literature.

Now this statement may seem to conflict with many statements that I have seen, and I know you have, that the Soviet institute works extremely fast. This 9- or 10-month estimate I obtained by talking to some 5 or 6 different Soviet physicists, all active in the field of nuclear physics. I asked each one—I asked him first of all: Did he use the Soviet institute abstracting service, and each one said no, because it takes too long to get the abstracts.

USE OF THE ALL-UNION

Mr. MITCHELL. Therefore they have the same type of problem at the moment?

Mr. HUGHES. They have the same problem. It is necessary to go a little bit, I think, into the reason a scientist uses an abstracting service—in a field such as nuclear physics, a physicist keeps in touch with what is going on by looking at a few favorite journals. When I asked Okun, who is a Russian theoretical physicist, when he visited Brookhaven, about the institute, he said that he didn't use the abstracting service in his field because he received the American Physical Review regularly and it was his primary source of information.

He said, however, that if he wanted to write a review paper, or look into the field slightly different from the one he worked in every day, then he used the abstracting service of the All-Union Institute. He said it was still operating too slowly, but after all, it has been going on for 4 years, and he felt that in another year or 2 the process would be speeded up a lot.

Mr. MITCHELL. In your contact with these Soviet scientists, did you get the impression that they had a preferred status in the Soviet Union?

SOVIET SCIENTISTS HAVE PREFERRED STATUS

Dr. HUGHES. There is no question about that, at all. They have a preferred status from the time they start to school. At the University of Moscow, for instance, a stipend is paid by the Government to the students for meals, board, and so on. This stipend depends on the field, and at the present time physics students get a higher stipend than students in any other field. And then of course when they graduate, the salaries for physicists are higher than, say, for the salaries of skilled workers, unlike the United States.

Soviet physicists, or scientists in general, have larger apartments than others. The living space allotted to each person in the Soviet Union is fixed by the Government. It makes no difference how much money the individual earns. A scientist gets one more room in his apartment than a nonscientist.

This fact was presented to us when we were in Moscow as a sign of the attitude of the Soviet Union toward scientists. They really thought highly of them.

Mr. MOSS. I would like to go over some of the same questions I directed to Dr. Berkner.

Dr. HUGHES. Yes, sir.

SECURITY VERSUS PROGRESS

Mr. Moss. I am dealing now with the area of security.

Do you think our present security system is helping or hindering our scientific progress, and could you give us some examples to illustrate your response?

Dr. HUGHES. I have very little doubt about the effect of the security system on our achievements because, as I mentioned, I feel there is no doubt about the fact that secrecy, any amount of secrecy, will hold back development. There is just no question about it.

The purpose of secrecy is to keep certain information of military value from circulating, and that secrecy will automatically retard our progress. There is no question about it. I don't see how secrecy could ever accelerate anything.

MULTIPLE CLEARANCE

Mr. Moss. Would you care to give us your views on the multiple-clearance system which is employed today requiring agency-by-agency clearance?

Dr. HUGHES. That again hinders the progress of science. I actually don't have statistics on anything like this. I can talk best from my own experience, and again I have Dr. Berkner's difficulty that if I give examples, I will probably get my clearance removed.

I can probably talk in a general way. I think it is possible to describe it without getting into too much trouble.

For example, scientists in our own laboratory at Brookhaven all have atomic-energy clearance, but we also have people at Brookhaven working for the Air Force. Now they have a certain type of clearance that I don't. Thus they may be making the same kind of measurements with neutrons that I am making, but their reports are sent to the Air Force, and I wouldn't be able to read their reports.

THE PROBLEMS OF COMMUNICATION

So the problem is, when I am with these people, whether to talk or not to talk. I don't know, if I ask them a question, whether it is on something I am not cleared to discuss with them. Now that is one difficulty—that we just can't talk about our problems freely because we all have these various shades of clearance.

The other difficulty shows up in exchanging the results of our research, or even in making measurements for people who have other types of clearance.

One problem that we run into at various times: We may get a request to make a certain type of measurement. Now this request, let us say, comes from the Navy, and the request may be for a certain nuclear cross section that we can measure, which is needed for a certain part of the Navy program. However, I don't have the clearance so that these people can discuss the problem with me. They can simply tell me, "We would like you to measure such and such. We can't tell you what we are going to use the measurement for."

HAMPERS INTELLIGENT WORK

The difficulty is, I can't make the measurement correctly unless I know how the result is going to be used. So we are continually in the situation, where a certain measurement is required; we don't know what it will be used for, so we really can't make the measurement intelligently. In fact, it is even difficult to ask for the correct size sample to get from these people, say, in the Navy, so we can make a good measurement; that is, we spend much time talking back and forth in a sort of mumbo-jumbo, without revealing information that is classified.

NEED TO KNOW

Mr. Moss. Now, a need to know would exist there?

Dr. Hughes. There is definitely a need-to-know criterion. You see, the feeling is that if I make the measurement, I really don't need to know anything about the submarine, we will say, in which the material is going to be used.

It shows there is something false about this criterion, because actually I do need to know in order to make a sensible measurement.

Mr. Fascell. I believe this last statement is the crux of the thing. In determining need to know, I would suppose two groups of scientists are talking mumbo-jumbo in order not to cross security lines. Somebody says, "This is ridiculous. We better get clearance on this."

The question is, Is that someone who grants clearance a person properly in a position to evaluate need to know?

BROADENS NUMBER OF CLEARED PERSONNEL

Dr. Hughes. The thing to do usually in a case like this is to clear one more person. They might say, "It is all right if Don Hughes knows about it." But what happened recently when I was away from the laboratory and one of the people from another project called, was that because I wasn't there, he wouldn't tell the man who was making the measurements for me what it was all about, because this man didn't have the clearance.

There really are many, many examples of this type where the measurements are made very ineffectually; they take a long time; they are repeated many times; simply because people aren't allowed to talk to each other.

ADDS TO COST

Mr. Moss. Is this costly to the Government?

Dr. Hughes. It obviously costs a lot. A lot of money is wasted.

Mr. Moss. What would you propose as a substitute for this agency-by-agency clearance? Have you given any thought to a system that might work.

Dr. Hughes. I have. I think what is needed is a classification system under which it can be decided that certain whole sections of information, certain whole fields are unclassified, and that other things of military importance are classified, and this delineation will extend throughout all Government agencies.

LINES OF CLASSIFICATION

Mr. MITCHELL. Can you define those lines adequately?

Dr. HUGHES. This was the question asked Dr. Berkner.

I think in many cases those lines can be defined very carefully.

In nuclear physics, the lines are defined right now rather well, I think, in the Atomic Energy Commission declassification guide. This guide states that something like every element with an atomic number less than 92 is completely unclassified. I mean it lays out what things are classified and what aren't. But this guide is not observed by, say, the Navy and the Air Force.

Mr. MOSS. You have a need, then, for uniform standards throughout all of the agencies?

Dr. HUGHES. I see no reason why a uniform declassification guide in the field of basic research can't be written that will apply to all agencies.

Mr. MOSS. But in the area where classification is considered necessary, you are still confronted with this compartmentalization as a result of classification of information.

Have you any ideas how a solution can be reached which would permit free discussion by cleared personnel and their free handling of classified information?

UNIFORM CLEARANCE

Dr. HUGHES. I would say the same thing would apply: that as much as possible one clearance should work for all parts of the Government; that is, in these cases that I am speaking of, I see no reason why a Q clearance, a top clearance in the AEC, shouldn't enable a scientist at Brookhaven to receive information from all the defense agencies. I do recognize the importance of information of immediate military significance as being material that should be kept secret, but the things I am talking about are scientific information that should not fall into this category at all.

Mr. MOSS. Mr. Fascell, have you questions on this?

Mr. FASCELL. Yes, I do, Mr. Chairman.

As a matter of policy and philosophy: do you subscribe to the theory that the easiest way to keep a secret is to keep it with one person?

Dr. HUGHES. It depends on the secret. I would say that the matter is deeper than the matter of just keeping a secret. The real matter is one of keeping our security, and I would say we keep our security—that is, we stay strong—if we accelerate our development as much as possible.

There are many things which we just shouldn't keep secret at all.

Mr. FASCELL. I understand this. What I am getting at is from the technical standpoint of maintaining security, would you subscribe to the theory that the best way to keep secrecy is to limit information to the smallest possible number of people?

THERMONUCLEAR FUSION

Dr. HUGHES. If that is the only objective—to keep a secret, I would say if nobody knows it, it would be kept most secret.

I would say the best example actually at the present time is the one that came up at the last hearing, almost 2 years ago, and that is the matter of thermonuclear fusion.

Mr. MITCHELL. Has that been declassified yet?

Dr. HUGHES. It is still largely secret in spite of the fact that many scientists argue it should be opened up. There will be a release of information later this week on the part of the British and the United States.

Mr. FASCELL. Let's turn this question around the other way. Let's take a specific military application of a scientific principle by the Army, which ought to be kept a secret. Is this a basis for keeping it from the Navy?

CRITERIA OF SECRECY

Dr. HUGHES. I would say if your only objective is to keep that bit of information secret, I would certainly agree with you. The fewer people who know it, the less chance there is that that secret will leak out.

Mr. FASCELL. Do you think it is a practical, reasonable theory?

Dr. HUGHES. If your objective is to keep this bit of information from leaking out, I would say "Yes."

Mr. MOSS. But you feel it should be weighed against the scientific progress which would result through the wider availability of the information?

Dr. HUGHES. What I just said applies if your only objective is to keep this information secret from a wider consideration, though, you have to weigh the benefits of the release against the dangers; the dangers as against the benefits of letting people know about it.

COMMISSION TO DECLASSIFY

Mr. MOSS. Would you agree with Dr. Berkner's suggestion that some commission be established to precisely define the areas of information demanding tight security and to bring about a release of the great mass of information which would contribute to technological progress?

Dr. HUGHES. I am not sure just where in the Government I would put this function. I would say that it should be a continuing job, that is, new facts are discovered all the time, and the question always arises when something new is discovered, whether it should be secret or not.

Now, the way things operate within the Atomic Energy Commission is that there is a declassification group, a group of people who represent the military and the scientists, and these people get together periodically and review the status of the Classification Guide in the AEC, and they have been changing that constantly. That method, by and large, has worked very well.

In my own opinion, really the only place it hasn'tworked is in connection with fusion. But otherwise in the Atomic Energy Commission, it has worked well.

Mr. MOSS. Can you appeal to this group?

SCIENTISTS VIEW ON BASIC RESEARCH DATA

Dr. HUGHES. Oh, yes. I have been in many arguments in connection with this group. I think if you try to look at the thing very simply, you would say that the scientists, or the needs of basic research, call for full disclosure of information. The military reasons, the military strategy, would be in the direction of secrecy. I think these are the two forces, within the Atomic Energy Commission; it is these two groups who talk it all over and finally reach some agreement.

I think within the Government it would have to be very high, because it would be, by and large, the Defense Department that was in favor of secrecy, and the representatives of science, the National Science Foundation and so on, would be for disclosure. Thus, I think you have to go high enough in the Government to where you get these two groups together. I don't say it could be done in the National Science Foundation.

NATIONAL CLEARINGHOUSE OF ABSTRACTING

Mr. Moss. In abstracting—let us stick with abstracting for the moment—would you favor a central clearinghouse?

Dr. HUGHES. I certainly would not favor something of the nature of the Soviet All-Union Institute. The Soviet scientists themselves told me they didn't think it was very effective, because the people in it were not technically trained.

My feeling is that the professional societies that we have in the United States have many people in them who are experts in their field and who are devoted to their field but who do suffer from lack of support, financially.

What I would tend to suggest is certainly something central, but that would be more a coordinating agency, an agency to hand out the money, an agency to investigate methods of reproducing the material, methods of storing the material, and so on, but not the people who read the articles and make the actual abstracts.

GOVERNMENT SUBSIDIES

Mr. Moss. You would employ a system of subsidy in publishing and abstracting and have a Government-sponsored agency to coordinate the efforts of private groups?

Dr. HUGHES. Yes.

I would think for basic research that the National Science Foundation is the logical place to put this centralized function.

I am not too clear on this myself as to what, by law, the responsibility of the Department of Commerce is, but I would feel that at some point the information ceases to be basic science in nature and becomes more commercial information, technological information, that one thinks of as the sort of thing that the Bureau of Standards handles or properly the Department of Commerce.

Mr. Moss. We are trying to determine the responsibilities of the Department of Commerce. At least we are trying to get a statement from them stating their understanding of their responsibilities.

Dr. HUGHES. I would hope that somebody knows how to draw a line between what is the basic science that I think of as the logical thing that goes with the National Science Foundation, and the things that have to do with commerce.

BASIC VERSUS APPLIED SCIENCE

Mr. Moss. Do you think that the line can be drawn between basic science and the application of scientific knowledge?

Dr. HUGHES. I think it can in the field I know best, which is nuclear physics, high-energy physics, and so on. I am not at all expert enough to say whether the same thing could be done, say, in biology or chemistry. It may be easier in my field, say, than in the field of chemistry.

INFORMATION PROJECT

Mr. MITCHELL. Do you agree with Dr. Berkner that a project of some kind should be set up, possibly under the National Science Foundation, to pursue this question of a multiple coordinate system?

Dr. HUGHES. I would be in favor of setting up a project in the National Science Foundation to investigate what can be done by all these methods. I don't think we can tell them that they should start a big project in multidimensional information retrieval. I don't think we really know enough yet to say how we should spend a lot of money.

Mr. MITCHELL. Such a project should be set up to investigate the feasibility of this.

MANY ABSTRACTING SERVICES

Dr. HUGHES. That is right.

You see, a lot of work has been done on the problem of how to abstract information. As Berkner said, there are many abstracting services now in operation. In some ways they cause a lot of confusion but at least there is a lot of experience in existence on the problems of abstracting.

Mr. MITCHELL. And you think such a project could pull this material together?

Dr. HUGHES. That is right.

Mr. Moss. If you were assigning priority to the steps for solution to some of these problems of scientific information, what would you assign the highest priority?

Dr. HUGHES. I think at the present time I would assign the highest priority to translation of Russian material. That is not translation of selected articles, but just straight translation of the entire Soviet journals.

Mr. MITCHELL. Should there be a centralized point in the Government where such translations are readily available?

Dr. HUGHES. Again I would say there should be a centralized agency or spot for coordinating all such work. But I think the way to get those journals translated is simply to farm them out to all the translation services that are now available. As far as the distribution of the printed translated journals is concerned, I would again tend to handle that through the professional societies. The Engineers Council, the

American Chemical Society, the American Physical Society, and so on.

Mr. MITCHELL. Making it available to them for publication after translation is done.

PUBLICATION BY LEARNED SOCIETIES

Dr. HUGHES. Whether the societies would publish the journal or some agency in Washington publish the journal, it doesn't make too much difference, but I say the societies know the people who need the journals.

Mr. MOSS. Can you think of any valid reason why we should classify any of the translations?

Dr. HUGHES. No, I would say it would be completely foolish to classify something that is already unclassified in the Soviet Union.

AID TO ABSTRACTS

Mr. MOSS. Now, on the list of priorities, where would you assign No. 2?

Dr. HUGHES. No. 2, I think I would make the abstracting service. But that is a very diffuse sort of thing. As I said we can't really dump a lot of money into that right now. As Berkner said it might add to the confusion. We first have to draw all these abstracting services together and try to decide where the money could be spent most effectively. That doesn't apply to translation because there I think the journals are just sitting there ready to translate.

CONFERENCE OF INDEXING AND ABSTRACTING IN PHILADELPHIA

Mr. MITCHELL. Dr. Hughes, are you aware of the fact that there will be a meeting in Philadelphia on January 29, 30, and 31 of the overall problems of indexing and abstracting?

Dr. HUGHES. I heard of a meeting that was mainly biological abstracters. I am not sure it is the same meeting.

Mr. COLL. It is an across-the-board meeting.

Dr. HUGHES. This is certainly a step in the right direction.

Mr. MITCHELL. Mr. Chairman, you will recall that you wrote a letter to the National Science Foundation requesting support for that movement. (See exhibit H.)

Mr. MOSS. Now, next to abstracting, what would be the third step in this list of priorities?

TEACH UNITED STATES SCIENTISTS RUSSIAN

Dr. HUGHES. I haven't thought about this too carefully, but offhand I would say the third one, which is even longer range, is to teach American scientists to read Russian. I think that is the real ultimate solution. Any American scientist who really needs to get into foreign literature can read French and German. At least read it well enough so he can get the meaning out of an article. I think we are at the stage now where the amount of information available in Russian is greater than the amount in German. And that, of course, is another big program. I don't know if the universities have the people available so they could institute courses in scientific Russian.

Mr. Moss. What priority should be assigned the item brought up by Dr. Berkner of permitting the Government to pay page charges on Government-sponsored projects?

Dr. HUGHES. That is something that should be done. I am not sure how large the problem is but I am sure within the entire Atomic Energy Commission, page charges are paid.

Mr. Moss. I believe Dr. Berkner recognized that.

Dr. HUGHES. If the AEC can figure out how to do it, probably the others can.

Mr. MITCHELL. Dr. Hughes, when you were chairman of the Federation of American Scientists you were involved in the exchange of scientific information with scientists in foreign countries. Dr. Berkner said that a scientific report can be sent overseas without restriction if it has been printed in a technical publication. But it is restricted if it has not been published. Doesn't this make the technical editor more or less a censor in the field?

EXCHANGES WITH SOVIETS

Dr. HUGHES. I don't quite understand all of this myself. The rules are not too explicitly spelled out.

For instance, within the Atomic Energy Commission, the rule is that unclassified information published or not can be sent to the Soviet Union if we receive material of comparable value.

Mr. MITCHELL. Whether or not it is published.

Dr. HUGHES. That is right. I send unpublished information regularly to the Soviet Union and I get such information regularly in return.

Mr. MITCHELL. Would you say that the problem has been smoothed somewhat as a result of the coordinated efforts of the Federation of American Scientists and this subcommittee?

Dr. HUGHES. Yes, I think your hearings were of definite value and the problem of the control of the export of technical information that was done through the Department of Commerce has been worked out in quite a satisfactory way now.

Mr. Moss. Are you familiar with a publication of the Library of Congress called the Monthly List of Russian Accessions?

Dr. HUGHES. I know of people who use it regularly.

Mr. Moss. Are you acquainted with the Office of Technical Services?

Dr. HUGHES. Yes. Some of our documents are distributed through them.

Mr. Moss. Are you familiar with the Armed Services Technical Information Agency?

Dr. HUGHES. I have heard that it exists. It is not anything that I use at all.

COORDINATION OF TRANSLATIONS

Mr. Moss. Do you know of any coordination in passing on translations with the Atomic Energy Commission?

Dr. HUGHES. I have a reasonably strong opinion that there isn't really much coordination in the handling of translations. This is an opinion on my part. I really don't have too much information. But I do know this story, for instance, of the seven translations of the Russian monograph which incidentally is a monograph by Block-

intsev called The Acoustics of Continuous Media. But I can't name the agencies who translated them because I don't know them.

OTS BUDGET INCREASE

Mr. MITCHELL. Mr. Chairman, OTS in the fiscal year 1957 had a budget of $576,000. In fiscal year 1958 they had a budget of $431,000. On page 401 of the budget for this year there is an amount which is $1,791,000 for the fiscal year 1959. This budget request indicates that funds will be used to establish a translation center for foreign technical documents and in addition a central clearinghouse for scientific and technical information. In addition, a bill has been introduced in the House to set up a similar translation center in the Library of Congress.

Dr. Hughes, would you care to comment on where you think such a translation center for the benefit of scientific and technical information should exist, to your knowledge, in Government?

TRANSLATION CENTER

Dr. HUGHES. I would say it depends on the kind of technical information it is meant to translate. If it is basic scientific information, it should be in the National Science Foundation. If it is work of a technological nature that has interest mainly to industry, to business, then perhaps it should be in the Department of Commerce. I am not too sure how the latter should be handled but I feel quite strongly that the basic scientific work should be in the National Science Foundation.

Mr. MITCHELL. But regardless of where, defining the lines as you have just now, you still feel there should be a central clearinghouse of such translations, somewhere?

Dr. HUGHES. Absolutely. I am against a central organization to do it all right on the spot, such as the Soviet Institute, which has 2,300 full-time workers in the institute in Moscow. I think that is not the way to do it.

Mr. FASCELL. You mean this all-union thing is an effort to catalog the entire body of science?

Dr. HUGHES. Yes. When I talked to Shikanov he mentioned they are now handling all physical and biological sciences and it amounts to almost half a million abstracts a year. He sort of rubbed his hands and he said "In a year or two we are going into humanities."

I say that is not the approach.

Mr. Moss. We have been discussing the abstracting of translations. How about the abstracting of purely domestic information that is developed in our own universities and by our own scientists?

TRANSLATION COSTS

Dr. HUGHES. Berkner and I, I believe, applied the abstracting to all information. They are two separate matters, the translation and the abstracting problem. What we are doing in translating and in abstracting is just a tiny fraction of what must be done. For instance, O'Dette of the National Science Foundation estimated it cost almost $10,000 to translate a journal for a year, and there were several

hundred Soviet journals that are good and really should be translated. There are many, many more but if you translate just the really good ones there are several hundred of them at $10,000 apiece, hence it would cost $2 million just to translate them, not even publish it. We are doing nothing like that in our presently known program.

Mr. Moss. In thinking of bringing Government into this field, either by subsidy or managing a program, an important consideration is always cost. And particularly when the Congress is being urged—as it is at the moment—to increase costs in all directions.

Do you feel that a much larger—not necessarily a crash program in this area—but a much larger effort would repay the Government through avoiding costly duplication in research?

MORE TRANSLATION URGED

Dr. Hughes. I don't think there is any question about it at all. The amount of money, whatever it is, 1, 2, or 3 million dollars, to translate a lot of Soviet journals, and the amount of money it would take to beef up the abstracting services and to coordinate them, I am very confident would repay many times over the actual amount of money that had to go into it. That is as the Soviet work gets better and better it will be just more and more necessary for us to keep up with it.

Mr. Moss. The first paragraph on page 3 of your statement reads: "The grave danger to the United States is that we may attempt to outdo the Russians at their own game." I wonder if you would elaborate on that paragraph.

SOVIET CRASH PROGRAMS

Dr. Hughes. My meaning there was that the Soviet system is one under which a lot of effort can be put on a single objective that can be obtained in a very short time. Then all the possible propaganda advantage can be made of it.

Now, a good example is the world's first atomic powerplant which was started up in 1954, long before any other atomic powerplants in the world. The Soviets simply decided to build that. They put all the men and money they needed into it. My point is that it was not a well-balanced development. They simply said, "We want one of those things running and we want it fast," and that gave them a big propaganda advantage at Geneva.

UNITED STATES PROGRAM BETTER BALANCED

Our atomic power development program is honestly a much better-balanced program. We develop lots of types of reactors and we are working on types that are much superior to just one that would be picked to develop as part of a crash program.

You see, if we, instead of having a well-balanced program, simply put all our people into doing something the Russians had done, but do it just a little bigger, by the time we get this thing, we don't get much propaganda advantage out of it. In the meantime the Russians will come up with somehing else and we still have to divert all these people off to building another thing in imitation of the Russians. We couldn't

possibly have a well-thought-out coordinated program if we changed the direction every time the Soviets did something new.

PROPAGANDA EFFECTS OF SOVIET SUCCESS

Mr. Moss. What effect does the Soviet success on these crash programs have on the world scientific community? Do you think it diminishes their confidence in American science and technology?

Dr. Hughes. I don't think it does. In my conversations with the Soviet scientists, they didn't seem very excited with sputnik. In fact, they were a bit surprised that we were so excited about it.

Mr. Moss. Have you had opportunities to discuss it with scientists from other free nations?

Dr. Hughes. I have talked with some of them and my friends have talked to many others. I think the same thing applies. I am thinking of the scientists, now, the scientists in basic research. They all seem to feel that the Soviet achievement was a great one but it was something in the applied line—it was development work. It really has no necessary reflection on the quality of basic research.

Mr. Moss. So the propaganda value is with the general public rather than the scientists?

Dr. Hughes. That is right.

Mr. Moss. Do you have any further questions?

SCIENCE AS PROPAGANDA

Mr. Fascell. As I understand your thinking, if the Russians are using science as an element of propaganda in the cold war, it would be very stupid for the United States to be a reactor.

Dr. Hughes. Yes. We should act, rather than react.

Mr. Fascell. In other words, we should be affirmative in what we do.

Dr. Hughes. Yes.

Mr. Fascell. You don't merely react to somebody else's discovery or application.

Dr. Hughes. This is a very difficult subject to decide in atomic energy, for instance, because we don't need atomic powerplants right now. We have lots of oil and we have lots of coal. But other countries do need atomic powerplants right now. So some people argue that because of the great propaganda value, we should have built an atomic powerplant before the Russians. I feel we should try to keep a coordinated program with our own needs in view.

Mr. Fascell. Now, does this last statement preclude any application of scientific effort, either in basic research or in applied technology, to the cold war?

USE AS PROPAGANDA DISTORTS AIM

Dr. Hughes. As a scientist my own feeling would be that a scientific development carried on for its propaganda value would be a sort of distortion of the purpose of science.

Mr. Fascell. But are not the Russians doing this?

Dr. Hughes. I am speaking as a scientist, I say. Now, I don't know if there should be a man from Madison Avenue in the Cabinet.

Mr. FASCELL. The question is should we make science a part of the cold war, or is it part of it already by virtue of the fact that the Russians are using it?

Dr. HUGHES. If you mean make it a part of the cold war—that is if you are thinking of it propagandawise.

Mr. FASCELL. The use of science for achievement of propaganda purposes.

Dr. HUGHES. Propaganda that is based on truth—if that is what it is—then I am all for it.

Mr. MOSS. Perhaps a greater overall scientific effort rather than a crash program in one direction would be most desirable.

Dr. HUGHES. That is correct.

BASIC RESEARCH EFFORT

Mr. MOSS. You place quite an emphasis throughout your statement on the importance of greater efforts in basic science. If you can figure it in percentage of national output, how much increased emphasis do you think we need on basic science?

Dr. HUGHES. In the first place, I think we have to realize that it is really quite small, now—that is, of the total national output of something like $400 billion. The amount of money going to research and development in the budget is about $4 billion, and the amount of that which is basic research is only about $400 million and that is just a tenth of 1 percent of the gross national income.

Mr. FASCELL. Mr. Chairman, may I ask a question?

Mr. MOSS. Certainly.

Mr. FASCELL. To be in proper perspective shouldn't we include whatever is spent privately in this figure?

Dr. HUGHES. We are talking about Government policy at the moment. If we want to talk about the total amount of money that goes into basic research I am not sure how much more would come from private funds.

Mr. FASCELL. The point is, Doctor, to evaluate Government policy we must know what the overall picture is.

RESEARCH SPENDING SHOULD BE DOUBLED

Dr. HUGHES. That is correct. The amount of money in the budget is about $400 million. I would say this might be doubled if we included private funds.

It is my feeling that this could certainly be doubled. It isn't that there is a shortage of ways to use the money at the present time. The National Science Foundation in their report stated they could have supported three times as much basic research as they did if they had enough money.

TRANSLATING AND ABSTRACTING

Mr. MOSS. Doctor, do you feel there is a critical need for immediate attention to the problem of translating and abstracting?

Dr. HUGHES. That is right. And the translating I would say is the No. 1 problem.

Mr. FASCELL. Mr. Chairman, may I make an effort to have this clarified—the priority of translation and abstracting to across-the-board security clearance?

Dr. HUGHES. There is same confusion. When we were talking about No. 1 priority, No. 2, and No. 3, we were talking in the context of flow of information.

Mr. FASCELL. Exactly.

SECURITY REVISIONS GET TOP PRIORITY

Dr. HUGHES. Security didn't come in there. I believe I would put security first.

Mr. MITCHELL. Removal of the multiple clearance system of security?

Dr. HUGHES. Yes. This is something we can do something about right now and it would have an immediate accelerating effect on our program, and it wouldn't cost us any money. It would save us some.

SCIENCE ATTACHÉS AIDED FOREIGN SCIENTISTS

Mr. MITCHELL. You were rather familiar with the science attaché program when it was in operation some years ago?

Dr. HUGHES. That is correct. I knew several of the science attachés. I knew even more about them by talking to European scientists who were helped so much by them.

USE FOR COUNTERPART FUNDS

Mr. MITCHELL. Dr. Berkner mentioned the difficulty in getting research papers by foreign scientists published in American journals.

Do you think counterpart funds could be effectively utilized for page charges in American publications if such a program were inaugurated?

Dr. HUGHES. There is no question about that. This would make the research available to scientists throughout the world and including them would be American scientists.

The work would not be published or published later, and it would be to our advantage to see it as soon as possible.

PAGE CHARGES TO FOREIGN SCIENTISTS

Mr. MITCHELL. Dr. Berkner said that the man who has done the research, his university or whoever he does it for, must pay the page charges which amount to about $20 or $25 a page.

Dr. HUGHES. That is right.

Mr. MITCHELL. If a foreign scientist presents a paper with merit—and I understand all of these papers are refereed as to their quality and worth—its publication in this country by one of our journals is impeded by the lack of dollars.

Dr. HUGHES. There is no doubt about it. That is exactly right.

Mr. MITCHELL. And our counterpart funds could be used in that type of a program?

Dr. HUGHES. That is right.

Mr. Moss. Dr. Hughes, again the committee is indebted to you for traveling to Washington and advising us as we continue our study of this very interesting problem.

Thank you very much.

The subcommittee will now stand adjourned until 10 o'clock tomorrow morning.

(Whereupon, at 12: 55 p. m., the subcommittee adjourned to reconvene at 10 a. m., Tuesday, January 21, 1958.)

AVAILABILITY OF INFORMATION FROM FEDERAL DEPARTMENTS AND AGENCIES

Part 15—Restrictions on Flow of Scientific and Technological Information

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TUESDAY, JANUARY 21, 1958

HOUSE OF REPRESENTATIVES,
SPECIAL SUBCOMMITTEE ON GOVERNMENT INFORMATION
OF THE COMMITTEE ON GOVERNMENT OPERATIONS,
Washington, D. C.

The subcommittee met, pursuant to call at 10 a. m., at the George Washington Inn, New Jersey Avenue and C Street SE., Hon. John E. Moss (chairman) presiding.

Members present: John E. Moss, Dante B. Fascell, and Clare E. Hoffman.

Also Present: John J. Mitchell, chief counsel; Samuel J. Archibald, staff administrator; Paul Southwick, professional staff member; Robert F. Coll, investigator; Ralph Widner, staff assistant; and Jack Howard, staff assistant.

Mr. Moss. The subcommittee will now be in order.

As we resume our hearings on scientific information, the first witness this morning is Dr. Wallace R. Brode. Dr. Brode is the new president of the American Association for the Advancement of Science.

The committee has taken note with pleasure of the announcement made last week of the appointment of Dr. Brode as Science Adviser to the Secretary of State. The committee notes that this appointment is the first step in the reestablishment of the science attaché program abroad as well as a step within the Department of State to assess the impact of scientific advances upon our national policies and status.

In view of Dr. Brode's limited service in the Department of State, we are not inquiring at this time with respect to the plans of the Department of State in the field of science, although this committee has previously evidenced its interest in this matter and will undoubtedly wish to hear from him on a later day on this subject.

Dr. Brode is not appearing today as a representative for the Department of State. But rather is appearing at the request of this committee as a recognized leader in American science.

Dr. Brode is an eminent scientist with long experience in academic and Government service, having served for many years as a professor at the Ohio State University and more recently as Associate Director of the National Bureau of Standards.

He is a recognized leader in the field of science, serving as an officer and member of the boards of directors of many of the Nation's

scientific societies and editorial boards, and has just taken over the responsibility as president of the American Association for Advancement of Science.

Dr. Brode, you have a statement you would like to read, I believe, at this time.

STATEMENT OF WALLACE R. BRODE, PRESIDENT, AMERICAN ASSOCIATION FOR ADVANCEMENT OF SCIENCE

Dr. BRODE. Mr. Chairman and members of the committee, I appreciate your expression of interest in the Department of State's fresh approach to this problem of science, and I shall be very pleased to report to you at a later date on its work.

Today I am concerned, however, with the general problems of science in the Nation.

Before I comment on the major problem before the committee, that is, the flow of scientific information, I feel it would be well to reaffirm what I believe are the basic concepts of a scientific method.

Scientists are not socially or intellectually a separate class of individuals, but rather they have a somewhat different approach to the advance of their knowledge and profession, which is necessitated by the nature of the subject matter concerned.

The scientist by nature maintains a critical attitude toward all unsubstantiated statements; his published papers are full of literature references to support those points upon which he does not present experimental evidence and his claims to new advances or discoveries are not accepted by others unless accompanied by sufficient reasoning or experimental details to permit those who doubt or do not comprehend to verify the conclusion experimentally.

Another characteristic of the scientific method is the recognition that progress in science is a cooperative and pyramiding affair in which each worker draws from the work of others to provide the base for his advances and in turn publishes the advances he has made so that others may profit.

This concept of publication and exchange of scientific information is not one of egotistical bragging, but rather the very fundamental basis of our great scientific advances in this century.

ISOLATION SLOWS PROGRESS

Individual isolation of either scientist, laboratory, agency, or Government from the rest of the scientific community will not only slow down the world advance but produce even greater retardation in the isolated area.

Kettering aptly stated this concept some years ago when he said that if he locked the doors of his laboratory to others, he would lock out much more than he would lock in.

No group or nation has a monopoly on scientific discoveries and thought, and hence security islands may create a retarded advance if there is no exchange and only a one-way filter.

Scientists are not inclined to pass out to others their concepts and ideas prior to formulation and proof in the form for publication, unless they feel that some exchange is possible so as to help them over an impediment in their own approach.

MULTIPLE CLEARANCES A NUISANCE

Now, concerning security clearance, I believe that multiple security clearances are not only a nuisance but by mere duplication have been known to result in conflicting determinations.

If a great many investigators make separate calls to ask about an individual, people become suspicious and skeptical.

Not all of this duplication is the result of stubbornness on the part of the separate agencies in declining to take anyone else's word, but some is due to the laws establishing funds or programs requiring specific and separate clearances.

There does not seem to be reciprocity with regard to clearances or even ability to retain a clearance status when one changes a position This may result in long delays and the deprivation of scientists from reference to their own experimental work.

Nondefense agencies who do no classified work except for defense agencies sometimes require separate security investigations, from the defense agency as well as their own.

Visiting foreign scientists who come to do unclassified work must have a full field classified investigation in some nondefense agencies. This clearance requires about a 6-month wait, and in authorizing the agency to receive the worker the security clearance is for "unclassified information only."

DETERS BASIC RESEARCH

I feel that in some cases the security clearance procedure and security classification is a deterrent to basic research and should be confined more generally to strategic information and hardware development.

Much has been said about the problem of overclassification and the need for declassification. I might cite only one case which indicates the principle and is perhaps a bit humorous.

BOW-AND-ARROW RESEARCH CLASSIFIED

One of the Nation's outstanding physicists has a hobby of archery, and is a pretty good archer. He has written books and articles, and has given technical and popular lectures on the physics of archery and the design of bows and arrows.

In the last world war he was one of the leaders in our advanced-science program, but at the same time managed to direct some experimental work on some new ideas on more efficient and effective bows and arrows.

This work was, of course, classified, and after the war he tried to get it declassified but without success. So far as I know it is still classified, although his motive in seeking declassification was merely to include in a popular lecture and a published article the general information that modern science might provide interesting improvement in this ancient field.

NEED-TO-KNOW CRITERION

I do not disagree with a broad interpretation of the concept of "need to know" as a qualification for access to information. The concept is certainly practiced today in such unclassified areas as medicine, technical process in an industrial company, census tabulations, and many other areas.

The need to know, however, must, in some degree, be based on the ability of the individual to properly use and comprehend the information, and this includes assurance that he will not use it improperly or injuriously.

In science it is just not possible to establish sharp barriers and many of our important discoveries are evolved from observations which may be merely noted as a byproduct of some investigations quite in another area, hence the need to know must cover wide areas.

In the area of basic knowledge the need to know is very broad and in the other extreme of hardware development or strategic information the need to know is very limited.

Our difficulties, I feel, have often been the application of the need-to-know principle as established for the strategic area to all areas of classification and sometimes even to unclassified basic research.

THE FLOW OF SCIENTIFIC INFORMATION

On the opposite side of the security impediment is the problem of coping with the tremendous amount of available information. Dr. Berkner in his presentation yesterday stressed many of the ideas and procedures on which scientists generally agree with regard to the mechanism of exchange and publication.

I would, however, like to elaborate on a couple of points which may be of particular concern to this committee.

Dr. Berkner started his chain of communication at the stage of public communication at meetings and formal paper publications. I would like to go back a step in the chain to the problem of reports.

Reports are in general made to the sponsor of a program; they may be progress or comprehensive reports and in general they are unedited by what is known as the referee and editorial process which is applied to published science.

I do not feel that unreviewed reports are properly classed as a part of the open scientific literature. As reports to sponsors, they may include preliminary discussions, general background material, untried postulation, citation of trade products by name in comparative tests, and reference to work in progress by others which may not have reached a publishable stage.

In the definition of classification as affecting the Nation's security such reporting may not be classifiable but at the same time should not be published without proper editorial surveillance.

THE REFEREE SYSTEM

An important concept in our scientific publication procedure is the referee system, which assures the reader that published papers have been carefully read by experts in the subject, and while the referee is not expected to repeat the experimental work—although I know of cases where this has been done and has even resulted in withdrawal of the paper—the guaranty of reasonable competence and content is essential so that valuable time is not wasted by the scientist on inconsequential or incorrect material.

Dwight Gray, in a recent paper in Physics Today entitled "Do Technical Reports Become Published Papers?" has pointed out that nearly 80 percent of the vast number of technical reports which con-

tain publishable material are condensed and published in a reasonable time.

PROBLEM OF GOVERNMENT REPORTS

Since the majority of our basic research is now subsidized by various Government agencies, nearly all of whom require some form of report, it becomes a governmental problem as to what should be done with these reports.

I would personally urge that reports should not be treated as publications and that governmental facilities or funds should not be devoted to the reproduction and public dissemination of material which has not been given a logical referee review and screening process.

I can conceive of an agency such as the Office of Technical Services issuing properly prepared and edited reports of an extended nature, provided an abbreviated version has previously been properly published.

In view of limited space in technical journals, it is obvious that extensive data and tables may need to be omitted and the extended tables which would be of interest only to a limited few could be obtained on request from the Office of Technical Services.

ABSTRACT CITATIONS

Literature citation in abstract journals should, however, be only to the published journal version. Our already staggering amount of literature is being complicated by some abstracting journals reproducing separate abstracts of the report and then the published article—which often has a different title.

RETRIEVAL OF INFORMATION

With about half a million scientific articles published this year, it is just humanly impossible for a single intellect to cope with this amount of information, which increases in size at more than 10 percent additional every year.

As Dr. Berkner indicated, it is necessary to subdivide science into areas, which subdivisions are increasing in number, and it is necessary to provide to these areas adequate abstracting services to bring essential facts to the individual and an adequate indexing system to permit location and retrieval of the information or segments of specific interest.

CHEMICAL ABSTRACTS CITED

Only in the field of chemistry, as maintained by the American Chemical Society's publication "Chemical Abstracts," can we be considered to provide our scientists with a reasonably complete abstract and index service.

The enormous size of this undertaking is indicated by the fact that last year's publication amounted to about 100,000 abstracts in 10,000 pages of close printing and the index alone to last year will amount to about 5,000 pages.

Some form of assistance is necessary to bring other sciences up to the "Chemical Abstracts" level and to accelerate the abstracting and indexing services of all areas of science.

TIMELAGS

Due to limited trained personnel and printing problems, there are timelags at nearly every step between the public release of information and its ultimate record in the index of the abstract compilation, at which point it becomes available to the scientist without such impediments as need for separate scrutiny of the vast literature, attendance at all technical meetings, or other activity which may by chance lead him to the information.

Unfortunately, our indexing process requires time properly to code, name, and cross-reference the hundreds of thousands of compounds and effects, so that we do not expect the index to the 1957 Chemical Abstracts to be published until the spring of 1959. Looking backward, this index, which will be available in about May of 1959, covers the abstracts of the year 1957, which abstracts in turn cover papers published for the most part in 1956 and the first half of 1957. These papers in turn cover work which was completed and released for publication in 1955–56.

REDUCTION OF TIMELAG NECESSARY

If we are to obtain and hold a lead in science, it is obvious that we must reduce this timelag and, at the same time, improve and expand our collection of scientific material by exchange and publication, as well as by abstract coverage. Research and assistance are required to improve both publication and indexing procedures.

The cumulative index to the Chemical Abstracts for the past 10 years is now being assembled for publication; it will amount to 19 volumes of about 1,500 pages each and will cost $2 million to publish.

The next decade will probably involve 2 to 3 times this amount, and its index will be an almost impossible task unless we can effect electronic means of indexing and retrieval so as to accelerate our publishing process.

It is essential that there be a strong program in research on methods of publication, abstracting, indexing, and retrieval if we are to cope with science of the future. I feel that much of the support should come from Government grants from the National Science Foundation for this work.

TRANSLATION QUESTIONED

In view of the suggestions of Dr. Berkner yesterday that consideration should be given to the translation of the Russian Abstract Journal—Referativnyi Zhurnal—about 60,000 pages per year in all sciences—I would like to comment that I do not agree with this recommendation. That there should be disagreement among scientists is not unusual, for I believe we are both basing our conclusions on acceptable but different data.

Such a division of opinion demonstrates the importance of adequate study before definitive action, and both Dr. Berkner and I urge that funds should be made available to the National Science Foundation to support studies by agencies, societies, or consultive organizations to establish the best procedure to improve our abstract and index services.

PHYSICS ABSTRACTS INADEQUATE

In the field of physics, which is of concern to Dr. Berkner, it is recognized that our available abstracts and index services in English are inadequate and the size and coverage of the Referativnyi edition in physics leads one to seriously consider the desirability of its translation.

In the field of chemistry, which is my major interest, there is a reverse situation even though the Russians are doing a relatively effective job.

The American Chemical Society's Chemical Abstracts is so complete and outstanding that it serves as the model and goal toward which others strive. This service to chemistry is a multi-million-dollar operation which is carried out on a businesslike basis with a balanced budget and with no supporting subsidies.

Mr. HOFFMAN. May I interrupt here. Where does that money come from?

Dr. BRODE. It is paid for by the subscribers. The subscription to this journal costs $350.

Mr. HOFFMAN. A commercial enterprise?

Dr. BRODE. Yes.

Mr. MITCHELL. Advertising?

Dr. BRODE. No advertising at all. It is purely straight subscription and no subsidy.

Mr. HOFFMAN. Pardon me for interrupting.

Mr. MOSS. That is perfectly all right. It is important that we have that information.

SOVIET ABSTRACT LAG

Dr. BRODE. Dr. Crane, the editor of Chemical Abstracts, informs me that a careful study of Referativnyi indicates a time scale of about 1 year on the average from date of the published article until publication of its abstract. In Chemical Abstracts, the average time is 5 months. To this Russian time, one would have to add in this country the delay in mailing, which may be 1 or 2 months. To the 7 or 8 months greater delay of receipt of Referativnyi delivery in this country as compared with the corresponding publication of abstracts in Chemical Abstracts, must also be added the time for translation and printing.

This delay might be justified if there were assurances of better quality and coverage but careful comparisons have shown that the journal Chemical Abstracts covers some 20 percent more material, provides better abstracts, and often publishes abstracts of Russian papers before the Russian Abstract Journal reports the same article.

INDEXING STRESSED

All of these time factors are minor, however, when one considers the problem of an adequate index, which according to Dr. Crane is the key to our scientific collection of knowledge.

The Russians are publishing a lot of abstracts but they are almost without indexes. Half the work of the Chemical Abstracts staff is devoted to indexes which amount to one-third of the annual pages.

Dr. Crane feels that more than half the usefulness of an abstract system is dependent on a good index.

The Referativnyi Zhurnal Khimiya is now in the sixth annual volume and to date no annual indexes have been published. The Russian Physics Abstracts, upon which they put a great deal of effort, has just issued a subject index for 1954. In this index there are approximately 1.8 subject entries per abstract as compared with about 6 subject entries per abstract in the current Chemical Abstracts index.

AID TO ABSTRACTS URGED

Existing abstracting services should be aided to improve their operation and new services initiated where there are deficiencies in our coverage. Where practical these services should be administered by societies and staffed by professional scientists.

Such operation would seem to be preferable, as demonstrated by the success of Chemical Abstracts, now in its 51st year, as compared with the Russian all-science center operation by professional abstractors which is now in its 6th volume and represents a 4th attempt at a Chemical Abstract journal, three such previous attempts having failed since 1925.

GOVERNMENT RESEARCH GRANTS SHOULD INCLUDE PUBLICATION COSTS

Much of the basic research in this country is supported by grants-in-aid from Government agencies. It would seem reasonable that either these grants should include the necessary funds or counterpart funds should be provided to cover the cost of publication, abstracting, and indexing so as to provide the essential information to the scientific public.

EDUCATION IN RUSSIAN LANGUAGE

In closing, may I comment that not all impediments to the free flow of scientific information require financial support to be eliminated. The need for translation service may be temporary and could be offset by adequate language education in the elementary schools. The use of new printing and reproduction devices could expedite the publication process.

REVISION OF COPYRIGHT LAWS

Some relief or revision of the copyright law would expedite abstracting and publication process. On the subject of copyright, the only mention of science in the Constitution is a statement that science should be promoted and that this promotion should be by patent and copyright acts.

Scientists concerned with our publication and reproduction problems find a strict interpretation of the copyright law a strong impediment to any abstracting, reference, or quotation. Modern science requires reproduction, abstracting, reference, and quotation; and controls that limit such activity should be revised to keep pace with the requirement of science and technology.

I have brought here just for your information the Russian Referativnyi Khimiya for July 1957, and also the American Chemical Society's Chemical Abstracts for July 1957.

The American Chemical Society's Chemical Abstracts is in much finer print and has many more abstracts covering 20 percent more material than the Russian Referativnyi [indicating]. Therefore, I feel that it is not desirable to publish a translation of this Russian journal.

Mr. HOFFMAN. Mr. Chairman, may I ask him a question?

Mr. MOSS. Certainly.

Mr. HOFFMAN. Then, in your opinion—first, you have been in this profession how many years?

Dr. BRODE. Thirty-five years.

Mr. HOFFMAN. Working right at it?

Dr. BRODE. Yes, sir.

Mr. HOFFMAN. Am I to understand that you think we have been doing a better job than the Russians?

Dr. BRODE. Right, without question in this field.

Mr. MITCHELL. In the field of chemistry.

Mr. HOFFMAN. Even in one field, if we can concede it.

Dr. BRODE. Oh, yes; without question.

Mr. HOFFMAN. I am glad to know it; I feel much better.

I think that is all.

INDEX OF CHEMICAL ABSTRACTS

Dr. BRODE. This, I would like to present, not by weight but merely by size. This is the index of 1 year of Chemical Abstracts, the annual index. It represents one-third of the total pages. It has about 5,000 pages. It is really the key by which one solves the problems to find what has been done.

This is an index only to the very abbreviated abstracts which in turn refer back to the original literature. With 100,000 abstracts which are in this journal, this index indeed is necessary to enable the scientist to find the information. Such an index in chemistry takes a year to prepare. No other science is as well provided for as chemistry, which has been done by the chemists themselves.

The $350 subscription looks staggering, but it is the cheapest scientific periodical that most libraries buy per word of printed material.

Mr. MITCHELL. May we see it?

Dr. BRODE. It will strain your eyes.

This concludes my presentation.

Mr. MOSS. The subcommittee at the request of the press will recess for a minute or two to permit the taking of some pictures.

(Whereupon, a short recess was taken.)

Mr. MOSS. The subcommittee will now be in order.

CLEARANCE SYSTEM

Dr. Brode, I gather from your statement that you favor an area rather than a need-to-know security clearance. I wonder if you would care to elaborate on this?

Dr. BRODE. You are partially right. As a matter of fact, I feel that in basic research an area and a need to know are essentially the same. Personally, I would prefer that security control should be limited only to the strategic or hardware areas. One of the greatest impediments to a research scientist is trying to decide whether the in-

formation in basic science he has in his mind is classified or unclassified.

Mr. Moss. I wonder if we can go over that a little more closely.

In the field of basic science, first, should we assume that you feel there are areas of basic science where classification is necessary and desirable?

Dr. BRODE. Yes; I think so.

Mr. Moss. There are, in your opinion, clear areas requiring classification in the interests of the security of the United States?

Dr. BRODE. Yes.

Mr. Moss. But people working in those classified fields of Government research in basic science should have access to all classified research data available from the Government?

Dr. BRODE. Yes.

Mr. Moss. Should scientists outside the Government with a very active interest have access to classified information in fields of basic science?

BASIC SCIENCE SHOULD BE LARGELY OPEN

Dr. BRODE. Yes; I think that in basic science the security clearance—if there is, and I believe there are some few areas where security should be maintained in basic science, very few though, that in those areas such as the nuclear area, the question as to whether one is in the Government or outside the Government is not important.

It is important to draw on the intelligence and knowledge of scientists who are capable of solving these problems.

Mr. Moss. You would then apply their previous clearance to anyone who might have an interest in the work being done in such an area?

Dr. BRODE. Yes, that is right.

Mr. Moss. Now in the area of applied science or weapons, we are told time and time again that each service insists on its own clearance procedures. Each service even carries clearance further by applying "need to know" to its own scientists in dealing with each other when they are seeking classified data outside of their assigned areas of interest.

Would you continue this system or would you permit all engaged in comparable work for the Government to have access to all information.

BROADER CLEARANCE URGED

Dr. BRODE. I think a clearance so that all who are engaged in comparable work could have access to all material in the area is important.

Mr. Moss. You would narrow the security areas and have area clearances rather than project-by-project clearance?

Dr. BRODE. That is right; yes.

Mr. Moss. Now in the question of abstracting and indexing which was discussed at considerable length yesterday with Dr. Berkner and Dr. Hughes, there would appear to be some difference of opinion, and I think we might clarify that.

Dr. BRODE. Yes.

Mr. Moss. Do you feel that a Government agency should handle the abstracting and indexing of scientific information developed within the Government?

Dr. BRODE. I think the really important point in your question is the last four words "developed in the Government."

My answer is "No," specifically, to the question. I think there should not be a Government agency which would handle the abstracts and indexing of material which is developed solely within the Government, because this is making a demarcation in indexing and abstracting according to the source of who did it, rather than the field of science. And I think that there should be no demarcation as to who did it or whose funds did it. I think it would be a waste of time for universities to list, abstract, and index in one volume all the publications from that university regardless of the field.

ABSTRACTING SHOULD BE BY FIELD

My urge is that the abstracting and indexing should be by field and area.

Now the great problem is to avoid duplication, and if one abstracts by institution and then also by area, there will be a cross duplication. Some of that exists now.

I think that Nuclear Science Abstracts, which is published by the Government, duplicates many abstracts which are now published in Chemical and Physics Abstracts. Nuclear Science Abstracts also has abstracts of reports which are not easily available and have not been scientifically refereed in the manner of a standard research article.

Mr. MOSS. Mr. Mitchell, you have a question at that point?

Mr. MITCHELL. Doctor, should the Government agencies be required to follow a uniform indexing and abstracting system if a good one is set up?

Dr. BRODE. Yes, by all means.

Mr. MITCHELL. In other words, today we have a situation where the Government agencies are not really following the pattern of, say, Chemical Abstracts or Physics Abstracts.

GOVERNMENT AGENCIES SELECT OWN SYSTEM

Dr. BRODE. I think today many Government agencies are free to select the system which they use. There are some agencies, such as the National Bureau of Standards where the editorial board, of which I have been chairman, has ruled that papers for publication by the Government should be scientifically styled consistent with the American Chemical Society and the American Institute of Physics systems. In this way, the papers may be comprehensible and understandable by a large group of scientists.

Mr. MITCHELL. Would you extend that system to the other Government agencies, such as Defense, AEC, and others?

Dr. BRODE. Yes.

Mr. MITCHELL. That would improve the system?

COMMON SYSTEM SHOULD BE ADOPTED

Dr. BRODE. I believe it would. I don't say that these agencies should be required to accept all of the editorial and abstracting procedures, but I would say that these people should get together with the technical societies and agree on a common system so as to reduce the confusion.

Mr. MITCHELL. Has that been done?

PHILADELPHIA MEETING

Dr. BRODE. It is being done.

There will be a meeting, I believe, next week in Philadelphia to discuss abstracting, and there will be people from the Government as well as the technical societies in attendance.

The chemical abstracts system of journal abbreviations has now been adopted by the physicists and geologists as well as the chemists.

It is being used by many of the Government agencies and has been accepted internationally as the official publication system by the abstracting board of the International Council of Science Unions. This is the agency which Dr. Berkner mentioned yesterday.

There is a great deal of progress being made in obtaining a common system of communication.

GOVERNMENT ROLE

Mr. MOSS. Should a Government agency be given the job of collecting, abstracting, and indexing scientific information developed by research organizations outside the Government?

Dr. BRODE. I don't think they should. I don't think a Government agency specifically should have the cognizance over collecting, abstracting, indexing basic scientific information developed outside the Government as well as in. Again the definition wasn't quite clear to me. This doesn't eliminate work in the Government as well as outside in my opinion.

Mr. MITCHELL. Yes.

JOINT EFFORT RECOMMENDED

Dr. BRODE. In other words, I would say, if it concerns all scientific information both outside and inside, then I think this responsibility should be handled by an organization or group representing all of these people together, both the outside and inside, cooperating together, either in technical societies, and sometimes privately published, sometimes published by the Government.

It depends considerably on the degree to which the responsibility is delegated. For example, if it deals in meteorology or weather observation work where 80 percent of all the meteorologists in the country are employed by the Government, it would seem logical that perhaps the Government should take the major responsibility and it should center there.

If it deals in an area where only a small percent of the scientists are in Government area and a large percent outside, then I think it should center outside.

SUBSIDY TO ABSTRACTS

Mr. MOSS. It was suggested yesterday by Dr. Berkner that we need some central coordinating agency to aid in developing uniform standards. It also would assist, through subsidy if necessary, the established abstracting and indexing publications to make available to American science the great mass of information published each year.

Dr. BRODE. I heartily agree with this. I concur heartily that we should have a central coordinating advisory system. I think this is probably a responsibility of the Government to provide the guidance and coordinating leadership, because so much of science affects and is important to the Government.

Mr. MOSS. You have indicated that the American Chemical Society has a self-supporting publication which is probably the equal of or superior to any publication in the world.

Dr. BRODE. I would like to say superior to.

Mr. MOSS. Superior—I am pleased to learn that.

Do we have any other field of science supporting a publication in a comparable position?

OTHER ABSTRACTING SERVICES

Dr. BRODE. We have a number of other abstracting services which are being supported either by the Government or by private organizations. These include Applied Mechanics Review, Biological Abstracts, Chemical Abstracts, Engineering Index, Mathematical Reviews, Meteorological Abstracts and Psychological Abstracts.

There are areas where we do not have it. In metallurgy abstracts, the Referativnyi is being translated at the present time.

Mr. MOSS. Is the field of metallurgy one of the most important fields?

ASTRONOMY'S LACK OF SUPPORT

Dr. BRODE. Yes, it is an important field.

Thus there are areas where they need help and need it badly.

There are also areas of science where there is no money. For example, in astronomy (until we get the space problem solved) the interest of industry is not very great. Therefore people who would subscribe to astronomical abstracts, etc., are few, mostly university professors.

Such a field does not have the great advantage that the chemical, physical and medical professions have of a backstopping industry which can pay good dollars for abstracting and indexing services.

Mr. MOSS. You would agree, then, with Dr. Berkner that a central coordinating agency under Government sponsorship is necessary and desirable?

Dr. BRODE. Yes.

SUBSIDIES SEEN DESIRABLE

Mr. MOSS. That subsidies to the existing publications to permit more abstracting and indexing is highly desirable?

Dr. BRODE. This is very true. In fact, I also agree with him that it should be desirable to permit the Government agencies to pay the page charge in those journals which depend upon this.

There have been requirements that all published material published by the Government must be done through the Government Printing Office, this makes it impractical for Government agencies to pay page charge for publication in certain scientific journals; whereas industries and universities pay this.

Mr. MOSS. AEC is the only exception; is that correct?

AEC CAN PAY PAGE CHARGES

Dr. BRODE. May I counter that? I cannot speak authoritatively but I think I know, because I am the editor of one of these journals which collects page charges, that AEC has a legislative system which makes it possible to contract its work out to private and industrial groups; for example, Carbide and Carbon Chemical operates the Oak Ridge Laboratory.

The University of California runs the Los Alamos Laboratory. These contractors are not bound by civil service or by other Government regulations with regard to printing; therefore, the page charge is paid by the contractor.

I do not believe that the AEC from its Government funds pays the page charge. This can be subject to confirmation, but I am reasonably certain that the page charge is paid by the contractor.

Mr. MOSS. You know, then, of no Government agency directly paying page charges?

Dr. BRODE. That is right.

COPYRIGHT LAWS

Mr. MOSS. You mentioned something about the need for revision of copyright laws in connection with the abstracting and publication process.

Dr. BRODE. Yes.

Mr. MOSS. I wonder if you might elaborate on that?

DAMAGE SUITS DETERRENT

Dr. BRODE. I might give two examples which show some of the influence.

In modern-day business and science there are of course heavy damage suits at times which intimidate or make one fear that if they do something they might have to pay heavily. There is a specific law which prohibits the copying or reproduction either in whole or in part of any copyrighted document without the approval of the copyright owner.

Up until last July, the American Chemical Society had maintained, with the cooperation of the Government, a photocopying service to provide scientists with copies of hard-to-get articles.

This service was very popular and widely used to expedite scientific research. We suspended this last July on advice of counsel because of this fear of suit.

Also, in the abstracting of technical articles it is not possible for an abstracting service like Chemical Abstracts to subscribe to a large number of copies of a particular journal, nor is it possible to tear these copies apart, because some articles start on the back page of another article.

Therefore it would seem desirable to be able to photo-offset by modern high-speed reproduction processes, Veri-fax, or other types, copies of short articles to be mailed to one of a large number of experts in the field to abstract.

This was being done, but has been suspended. It is slowing down the abstracting process. These are complications which involve the copyright laws.

Mr. Moss. It was the process of copying for use in abstracting rather than the use of the material itself in abstracts that brought about the difficulties?

Dr. Brode. Yes.

Mr. Mitchell. Was that Government counsel that advised you to drop the photo-copying?

CONGRESS CONSIDERING REVISION

Dr. Brode. No. It was not. It was the Society counsel.

I understand that there is under consideration a revision of the copyright law in Congress. I think this would be an important thing to consider: In the modern trend science reproduction, or copying is important. In one government agency it was indicated that workers should not copy anything from any copyrighted article, even so much as a single copy for one's personal use, as for example making notes in one's notebook of material from an article, without getting permission of the copyright owner.

Essentially, every abstract is a violation of the copyright, as I understand it, because the abstract is a reworded statement written intentionally to be the same idea that the original author was trying to convey.

Mr. Mitchell. Do you know if this policy has been presented to the Senate Subcommittee on Patents and Copyright Laws?

Dr. Brode. I believe it has.

Mr. Mitchell. It has?

Dr. Brode. Yes.

STORAGE AND RETRIEVAL MACHINES

Mr. Moss. You mentioned the need for development of a machine for retrieval and storage of scientific information. Do you know of any examples of a system with any great potential to it?

Dr. Brode. Yes, we are making progress. Our high-speed electronic computing machines that do mathematical problems can be coded to do all kinds of problems. We have at the National Bureau of Standards been working for the Patent Office to develop a coding system by which you could put in all of the known families of one of the complicated durgs, such as sterols. Then you could ask this machine: Is this compound patented? And you put in the machine a structural formula by the mathematical code, and out comes the answer in a short time indicating whether it has been patented, the proper name of the compound, and the patent number.

INCREASING USE BY INDUSTRY

Such patent search can be extended. Such mechanical service is being accepted in industry where they use these computing devices widely—IBM and other devices, for searches they actually put into the machine any structural formula in any order of a chemical compound, and the machine goes through a million or a trillion divisions and comes out with the proper name of the compound.

This could be done, I believe it can be done provided some funds are made available for research in this area. It would, I think, shorten the time of the publication of the index of Chemical Ab-

stracts by at least 50 percent; and this is one of the major delays or plugs in our research line.

Mr. Moss. That would be true of all other fields of science?

COULD BE USED IN OTHER BRANCHES OF SCIENCE

Dr. Brode. It would be true in biology, medicine, and many other fields—where material can be coded and put into a machine.

I think you can establish a research, retrieving, and indexing procedure, although it will take some time to develop this procedure. It must be done in the future.

Mr. Hoffman. That is merely a development of what the supermarkets have in their machines. They tell you how much you have coming right off the bat.

Dr. Brode. That is right. They have very efficient machines.

Mr. Hoffman. Your thought is to keep it up?

Dr. Brode. Yes. Modern technological age.

MACHINES WOULD SAVE MONEY

Mr. Moss. Do you feel there would be any savings in Government-sponsored research and developmental projects if we could tap this information that is already available on a day-to-day basis?

Dr. Brode. Tremendous savings.

Mr. Moss. It would avoid much costly duplication?

Dr. Brode. Yes.

Mr. Moss. Do you know whether requests have been made for sufficient funds to underwrite the research necessary to bring about the development of such machines?

Dr. Brode. I believe there are several agencies that are interested in this, and I believe requests have been included for this type of research.

Mr. Mitchell. Do you know of any specific agency that you think should handle this machine development project, rather than having many active in the field?

ADVOCATES SEVERAL DIFFERENT APPROACHES

Dr. Brode. I would like to say that more than one agency should do it. This is an experimental problem and there must be several different aproaches to this.

I think the National Bureau of Standards is one agency, because we have been working in this field. There are many other areas, such as places like Massachusetts Institute of Technology where they have been working on the same problems with regard to machine translation, using these same devices to do translation of technical articles.

Mr. Moss. Is there proper coordination of the research efforts in this field?

Dr. Brode. Yes, I believe there is.

Mr. Moss. Do you know whether an adequate volume of foreign scientific research is now being translated?

SCOPE OF TRANSLATION PROGRAM

Dr. BRODE. To answer this, I would perhaps disagree a little bit with Dr. Berkner. We are doing a pretty good job in translating much of the Russian material and the balance which is not being translated will be taken care of, I believe, providing some additional funds are available.

We are by no means without translations of Russian material.

The question was whether—and Berkner also mentioned this—an adequate volume was being translated.

I would say in the areas of French and German, an organized translation should not be done. Scientists should be expected to read these languages; and I think ultimately in the future our scientists must learn to read Russian. In the interim there will have to be translation.

Mr. MITCHELL. What about the field of Japanese?

Dr. BRODE. I think in the field of Japanese that there will be a compromise. I believe the Japanese scientists themselves recognize that they must essentially think in either French, German, or English, because of the large volume of material already existing in these languages. Nearly all of the Japanese scientific and technical journals are in English, French, or German. For those journals published in Japanese, the better articles are translated and republished by the Japanese.

Mr. MOSS. You feel that we are making progress and that we are now translating a substantial volume?

Dr. BRODE. That is correct.

NOT TRANSLATING ENOUGH

Mr. MOSS. But are we translating, in your judgment, an adequate volume?

Dr. BRODE. Not adequate. There should be more subsidy to do this.

Mr. MOSS. Mr. Hoffman, do you have some questions of Mr. Brode?

SECURITY QUESTIONS

Mr. HOFFMAN. Yes. From the first paragraph on page 1, I gather that scientists don't trust anyone. They have to be shown before they will go along with an idea.

Dr. BRODE. I think you are right. They are skeptical.

Mr. HOFFMAN. Then, over on page 2, in the first whole paragraph there you seem to get away from that idea when it comes to a question of security. Unless I do not interpret it correctly, you think one fellow would be enough and the rest of the agencies would take the evaluation fixed by the one.

Dr. BRODE. I tried to point out in my first paragraph that there was a scientific approach. In the scientific process of reasoning to solve problems, one must have an open mind and be willing to try every procedure and every possibility.

From the standpoint of security, this is a social aspect and here one must accept the decision of those who have the proper knowledge.

Mr. HOFFMAN. But if you get just one boy to pass on security and he happens to be off color, then you get a long list maybe—well, in the past we have had a long list of Communists sitting right here in Washington. You are familiar with the names of them.

It wasn't a question whether they were or were not. They have admitted under oath they were Communists.

You would not have one group to pass on security, would you?

Dr. BRODE. Your inference is that scientists might blindly go down the line if someone was leading them astray is not correct.

Mr. HOFFMAN. Scientists do not do that at all?

Dr. BRODE. I agree with you heartily.

Mr. HOFFMAN. On the security business, no group should be in a position to say that Mr. A is all right, he isn't going to do harm in this Government of ours. And I reached that conclusion from what has happened.

SUPPORTS DECLASSIFICATION COMMISSION

Dr. BRODE. Dr. Berkner pointed out yesterday in the staff of the security office there should be a panel which includes not only the scientist but the lawyer and the businessman and others, so as to make these policy decisions. And I think this is the type of group that should make the ultimate decision on this.

Mr. HOFFMAN. I am thinking about any department, any one of the departments, Commerce or any other. If they should accept the decision of one group about the loyalty of their employees, we get into trouble.

Shouldn't there be more than one agency to pass on security, not to be specific, but am I to be required to accept the judgment, if I was a Government official, of the ADA or that group that was here some time ago that was publishing the New Republic or some papers back there that went out of existence, or the Daily Worker?

You wouldn't accept the judgment of the Daily Worker as to patriotism or loyalty?

Dr. BRODE. Of course not.

Mr. HOFFMAN. Suppose the group happens to obtain political control here and, naturally, believing they are right, and to save the world, we must accept their ideas.

Dr. BRODE. I don't know what kind of regulations one would establish so as to prevent anyone who obtained political control from exercising their own decisions.

Mr. HOFFMAN. Not unless they went too far and we followed the South American idea.

Dr. BRODE. It is a problem which is outside the scientists' zone of decision.

Mr. HOFFMAN. I know, but you have scientists; presumably they are all loyal and patriotic. But if one should slip in who was not, should he not be pushed on the outside?

Dr. BRODE. Yes. I think there always should be some control, some method of screening so as to insure that such things do not happen.

CENTRAL INTELLIGENCE AGENCY CITED

Mr. HOFFMAN. My thought was as to whether you think in view of that first paragraph on the second page, whether that should be

left to some one individual or agency, or whether some of the departments—for instance, what is the one that gets money from us and does not tell?

Mr. Moss. CIA.

Mr. Hoffman. CIA. Yes, they pass on many of the questions of whether the individual is loyal. But should it be limited to the one?

Dr. Brode. I would prefer that it be limited to a joint group.

Mr. Hoffman. Now, you are getting some more in. Joint.

Dr. Brode. Representing the separate departments and agencies.

Mr. Hoffman. Like the Joint Chiefs of Staff?

AVOID MULTIPLE CLEARANCE

Dr. Brode. In which you do not have this problem of requiring separate clearances in every agency and in which there are rules and regulations in one agency with regard to clearance which make a person clearable in one agency and not in another.

Mr. Hoffman. I can go along with you—I guess everyone can—with the idea that there should be some uniformity.

Dr. Brode. That is right, and the uniformity must be some joint agreement between the separate departments.

Mr. Hoffman. Not just one individual?

Dr. Brode. Not one individual.

Mr. Hoffman. I want to thank you, and it is a pleasure to be reassured that we aren't due tomorrow to be wiped off the map.

One other thing. I think you spoke about there being no financial support or interest to any amount, at least, back of this investigation of space, didn't you? No money coming for that now from private individuals, that is, no large amounts?

Dr. Brode. No subsidies to the abstract journals that deal in astronomy.

Mr. Hoffman. From industry?

Dr. Brode. From industry.

Mr. Hoffman. Perhaps from the Government?

Dr. Brode. There is some from the Government.

Mr. Hoffman. The reason for that was that they haven't had anything to sell. There has not been a market for space information, while for instance, Dow Chemical Co., they have every reason to try to put in something new and then sell it, and they are successful at it.

Dr. Brode. There is considerable sale in space books and rocket magazines.

Mr. Hoffman. Yes, for the kids. But that isn't sufficient for the demand, there is quite a difference.

That is all, I think.

DECLASSIFICATION COMMISSION SUPPORTED

Mr. Moss. Dr. Brode, as I understand it, you would go along with Dr. Berkner in his recommendation that some central agency be established to determine the areas of science which should be classified and those which should not be classified?

Dr. Brode. Yes, I would.

Mr. Moss. This would have broad representation from the Government, from industry and science.

Dr. BRODE. Right.

UNIFORM CLEARANCE URGED

Mr. MOSS. On the matter of personnel clearance you would have a uniform standard. When the security board of, for example, the Department of the Air Force granted a clearance it would not be necessary if the individual started working for the Department of the Army to go through the entire clearance procedure all over again?

Dr. BRODE. This is true. I would like reciprocity with regard to clearances. Right now, we do not have that, and part of the reason is due to legislative action. For example, funds granted to the State Department for certain foreign-aid programs require that the individual be cleared specifically. Although he may have many other clearances, he must wait until there is another clearance established so that he may work with that particular fund, because there is attached to the law a statement that the clearance must be specific.

Mr. MOSS. Of course, that could be handled by agreement. If the Department of State felt that the clearance procedure of the Air Force was adequate for its needs, it could administratively agree that the Air Force clearance would apply, could it not?

Dr. BRODE. I am not quite certain, because in the regulations there are indications that certain points must be covered in one clearance, which are not listed in another. For example, in certain State Department——

Mr. MOSS. You said regulations?

Dr. BRODE. Yes.

Mr. MOSS. Then, of course, that is an administratively arrived at, rather than statutory requirement.

Dr. BRODE. I think maybe you are right.

INFORMATION PROBLEM OF THE SCIENTIST

Mr. MOSS. What problems does the scientist face in collecting the information necessary to complete a specific research project? And are there any important differences between the problems faced by a scientist within the Government and one working outside the Government?

Dr. BRODE. I don't think there are any important differences faced by the scientist inside and outside. I have long carried the torch for the concept that a Government scientist is just as respectable and has the freedom essentially to participate in American scientific operations, societies, and discussions as does the university scientist.

I think that perhaps the Government scientist has one impediment which is really a help. Any Government publications he writes must be cleared by a proper scientific screening or editorial board in the agency concerned.

In contrast, most university professors, in line with what one might call academic freedom, are free to send any publication they like, although the people who are best able to review this and assess whether the man's equipment is good, are in the university itself where he is located. It would help if there were some scientific

screening in the universities themselves of publications prior to submittal to journals.

Mr. Moss. But you would leave that to the scientific community itself?

Dr. BRODE. That is right.

EXPORT OF INFORMATION

Mr. Moss. Should there be a system of control of strategic but nonclassified scientific information disseminated overseas?

We had an agency until about a year ago, the Office of Strategic Information, which attempted to exercise authority in this field. Is such a function to your knowledge being handled by any other agency?

Dr. BRODE. Well, in reply to the first part of your question whether there should be such an agency, I think I can answer this in slightly reversed form. I know of no scientists who approved the system of control of nonclassified information as was established by the Office of Strategic Information.

As to whether such control still exists, I think there is a vestige of this. Many agencies, many organizations took actions in line with the suggestions of the Office of Strategic Information.

For example, in the Office of Export Control, the regulations on export control of technical data were stiffened up as a result of the original announcements of the Office of Strategic Information. Many of these regulations, so far as I am aware, still exist, although the OSI has been eliminated.

REQUIREMENTS FOR EXPORT OF INFORMATION

As for example, scientists are still required to mark on the outside of certain letters or publications which they send abroad, the statement "Export license not required." The Federal Register contains the explanation that scientists must stamp "Export license not required" on their communications in order to indicate to the post office and other inspectors that a general license is required.

This is confusing to the scientist, first as to why they should have to do this.

REGULATION WIDELY DISREGARDED

In Europe, I made some study to see how effective this control was and I think it is perhaps honored in the breach about as effectively as the 18th amendment was, in that some do and some don't.

This confuses the European scientists who dont' understand why some people do it and other people do not.

I think it is confusing, but here is one other item equally confusing to the editors of technical journals, and I am an editor of one of the technical journals. This is the general requirement, which I think came out of some of the Office of Strategic Information regulations or suggestions, that if an article has been published in a recognized scientific or technical journal, it may be freely mailed throughout the world. There was a time when this could not be done, but now it can be done.

Mr. MITCHELL. Without this stamp?

Dr. BRODE. I am not quite certain. I think the regulation requires the stamp still.

Mr. MITCHELL. Right.

Dr. BRODE. On the second-class material, but not if you put it in a first-class envelope.

Mr. MITCHELL. This is in accordance with export control regulations?

Dr. BRODE. Yes.

Mr. MITCHELL. That is all done by rule and regulation and not by law or statute?

Dr. BRODE. I believe so; yes. I think the public at large is sometimes confused as to the difference between regulation and law, because both of them have penalties attached to them for violation.

COMMERCE DEPARTMENT TIGHTENED EXPORT RESTRICTIONS

Mr. MITCHELL. The reason I raised the question was this matter was brought to the attention of the Department of Commerce some time ago. They were supposed to revise the export rules and regulations, and this subcommittee had assumed that that had been done.

But after 6 or 7 months had transpired, letters began to come to the subcommittee again that the rules had been tightened, as you said this morning, based on OSI regulations.

CENSORSHIP BY EDITORS

Dr. BRODE. You asked this question yesterday, if I may get back to the question of the editor. The editor has to decide whether the article submitted to him should be published or not. He may reject it because it is no good. He may send it to another journal or he may require the author to compress it and remove parts of it because of the length.

If he rejects it or requires the author to eliminate some tables the author may not mail these omitted tables or the rejected article to certain areas of the world, if it deals with certain subjects. But if the paper is published he may send it. Therefore, in a sense, the editor is set us as a censor to decide whether this man's material may or may not be disseminated freely.

Mr. HOFFMAN. He is a classifier.

Dr. BRODE. He is a classifier in a certain sense.

Mr. MITCHELL. From a scientific point of view.

Dr. BRODE. None of this material is security classified.

EDITORS NEED GUIDANCE

Dr. BRODE. The editor has no guidelines and this is what the editors feel somewhat uncertain about. They have not been told whether they should reject articles in a certain field and suggest to the author that he use the need-to-know classification to disseminate this among his friends.

Mr. MITCHELL. Who would tell him?

Dr. BRODE. I don't know.

Mr. MITCHELL. In a field of nonclassified information in private industry, should a Government agency tell him?

Dr. BRODE. If it is an essential control, it should be by Government agency.

Mr. HOFFMAN. Otherwise, he uses his own judgment.

Dr. BRODE. That is correct.

Mr. HOFFMAN. It can't be otherwise.

Dr. BRODE. We arrived at this in the last World War quite effectively. Originally they started to have an office of censorship and send all technical articles there and finally they came to the conclusion that the best person to make the decision as to whether the article should or should not be published is the editor himself and his editorial boards.

What the editor needs, though, is some advice from Government as to areas or fields in which he should use caution.

Mr. MITCHELL. Should this come from the security officers, or should it come from a man in the scientific community who understands what has been published and some of the problems involved?

COMPETENCE OF OFFICIAL STRESSED

Dr. BRODE. It should come from a scientist in an intelligence agency and one in whom the editor and author have confidence. The scientist will respect the decision of another scientist in whom he has confidence.

The scientist wants to know who is the author of this regulation. Is this a competent official? Did he have reasons?

You don't have to know his reasons. If it is a competent official in whom he has respect and confidence, he will accept this.

Mr. MOSS. It isn't the policy of the editor to refuse publication because he consciously questions whether it would be circulated abroad?

Dr. BRODE. No.

Mr. MOSS. So this is merely an inherent effect of the editor's decision as to whether or not to publish?

Dr. BRODE. That is right.

Mr. MOSS. To me, it appears that this is an unworkable and confusing regulation. It is ignored, in other words, by far more than observe it.

Dr. BRODE. Yes.

Mr. MOSS. It serves no useful purpose.

Dr. BRODE. In the method by which it is operated.

OUTGROWTH OF OSI

Mr. MOSS. My view would be exactly what it was last year when we recommended that OSI be abolished. I think a regulation that grew out of that confused organization is just as confused as the organization and should go the way of that agency.

Now yesterday I asked Dr. Hughes for a list of priorities—steps that he felt would be most helpful in the field of scientific information in order of importance. I wonder if I could ask you to give us some priority steps which you feel are most important.

PRIORITIES FOR SPEEDING INFORMATION FLOW

Dr. BRODE. This is in the order of priority with respect to the flow of scientific information?

Mr. MOSS. Yes.

Dr. BRODE. For science as a whole, I believe getting underway and establishing an adequate abstracting and indexing system for all sciences, I think indexing is just as important as abstracting, and is the key to science. This means research on retrieval and indexing.

Mr. MOSS. What would your No. 2 priority be? You have given equal weight to both abstracting and indexing?

UGRES BASIC RESEARCH GRANTS

Dr. BRODE. Yes. One should not be done without the other.

My second priority, I think, is the education of scientists and the provision of adequate research funds, research grants to produce this information.

Mr. MOSS. Grants for basic research?

Dr. BRODE. In basic research.

Mr. MOSS. Dr. Hughes, of course, is a physicist working in a field sponsored almost entirely by Government. After he had reviewed his priorities he decided that the first should be the modification of the current Government security system.

Where would you assign that problem?

Dr. BRODE. No. 3. I might say that Dr. Hughes works in an area which is highly classified and I do not. Therefore, from my point of view, this is my opinion.

STRESSES IMPROVEMENTS IN ABSTRACTING, INDEXING, AND RETRIEVAL

Mr. MOSS. Do you feel that the need for improving abstracting and indexing services and speeding the retrieval of information is an urgent problem?

Dr. BRODE. Yes; it is urgent and the longer we wait the more difficult it will be to solve it.

Mr. MOSS. Mr. Hoffman, do you have additional questions?

Mr. HOFFMAN. I understood that in your opinion certain deferences and consideration should be given to scientists because of their special knowledge when it came to security tests.

Dr. BRODE. No. I don't believe I felt that.

Mr. HOFFMAN. Perhaps I misunderstood.

Then it is your opinion that the same test should be given to the scientist when it came to the question of security that should be given to other individuals?

Dr. BRODE. That is right.

Mr. HOFFMAN. Subject to at least some of the frailties?

Dr. BRODE. You are quite right. Where the confusion may have arisen is that I thought different consideration should be given to science—scientific subjects.

Mr. HOFFMAN. Not to individuals?

Dr. BRODE. It is like this word "classification" which we discussed yesterday. Sometimes "classification" means areas of science and

sometimes it means security. When I said subjects, I meant astronomy, physics, chemistry, and not this man or that man.

Mr. HOFFMAN. That is to say scientists possess at least some of the weaknesses——

Dr. BRODE. Yes.

Mr. HOFFMAN (continuing). Of, say, a Senator?

Dr. BRODE. I wouldn't say that.

Mr. HOFFMAN. A Congressman?

Dr. BRODE. Yes.

INTERNATIONAL SCIENCE MEETINGS IN UNITED STATES

Mr. MOSS. Dr. Brode, in your new role as science adviser to the Department of State, you are going to have some important contributions to make to a problem mentioned by both Dr. Berkner and Dr. Struve when they appeared before the committee 2 years ago.

Would you agree with them that there should be more international scientific meetings held in this country under the sponsorship of American science?

Dr. BRODE. Yes, I would.

Mr. MOSS. Would you feel that this is important enough to have the Government give some financial backing?

Dr. BRODE. Yes, I think it is important that it give financial backing. I think it is very important for our younger scientists to have the opportunity to meet and see and hear the discussion of these experts from abroad, and we cannot afford to send them all there.

We can bring, from time to time, these outstanding scientists to this country at the time of inernational conferences and every time one of these is held these scientists will make many lectures and appear before scientific societies and will, I think, spread the exchange and interchange of knowledge.

Mr. MOSS. What is the policy of other governments in this field? Do they assist the scientific organizations?

Dr. BRODE. Other governments assist.

SECURITY SYSTEM

Mr. MITCHELL. You have been in the Government service for quite some time. The chairman touched on two basic security questions this morning. These were need to know and the multiple-clearance system.

For the past 2 years this subcommittee has listened to testimony that these 2 stumbling blocks to science could be junked at an administrative level. Do you have any suggestions as to how this can be done with all the agencies of Government? For example, should the President direct certain agencies to get together?

Dr. BRODE. I expect that is the answer. I don't know how it will be done unless there is some strong directing force telling these people to get together and solve this problem. I think probably——

Mr. HOFFMAN. Will counsel yield there?

Mr. MITCHELL. Yes, sir.

Mr. HOFFMAN. You say the President should do this. Suppose the President has told them; how is he going to make them do it? Do you know?

Dr. BRODE. I do not.

Mr. MOSS. What was this?

Mr. MITCHELL. In the field of need to know and central clearance.

Mr. MITCHELL. The reason I raised the problem is because this is a difficult area in which to legislate. How are we going to get this condition corrected?

SUGGESTS PRESIDENT'S SCIENCE ADVISERS

Dr. BRODE. I feel that perhaps the "new look" on science through the President's Advisory Committee on Science may be of some help in the solution.

Mr. MOSS. Dr. Brode, the committee is extremely grateful to you for giving your time, particularly when you are embarking on a very important new assignment, and appearing here to give us your advice in the study of problems involved in the flow of scientific information.

Dr. BRODE. Thank you, very much.

Mr. HOFFMAN. And one-third of the committee, the Republican third, wants to join in that wholeheartedly.

Dr. BRODE. Thank you, Mr. Hoffman.

I am leaving this afternoon to go up to Detroit to lecture.

Mr. MOSS. Our next witness is Dr. Hiden T. Cox, executive director of the American Institute of Biological Sciences.

Dr. Cox.

STATEMENT OF HIDEN T. COX, EXECUTIVE DIRECTOR, AMERICAN INSTITUTE OF BIOLOGICAL SCIENCES

Dr. COX. Mr. Chairman, members of the committee, I shall refer to some activities of the American Institute of Biological Sciences, but I want to put into the record that the opinions expressed in this statement are mine, as a professional scientist, and of course do not necessarily reflect the views and policies of the AIBS.

Science thrives in a climate of free exchange of information. This is a self-evident fact and one that need not be belabored. There must be free exchange regardless of language barriers, or geographic barriers, or political barriers, or any other artifically imposed barriers.

BARRIERS TO INFORMATION FLOW

There are now a number of such barriers which do seriously impede the free exchange of scientific information.

To understand how barriers to effective exchange of scientific information have developed, one must first understand how scientists communicate with one another.

I apologize, there will be some repetition here of what Dr. Brode and others have testified, but I will make it as brief as possible.

First, and unquestionably of most importance, is communication by means of published scientific research papers. These scientific papers are published in periodicals or in occasionally published papers, or in books. I shall return to this later.

PERSONAL CONTACTS

A second way in which scientists communicate is by personal contact. National scientific meetings, regional meetings, and international meetings and congresses give opportunities for scientists to present papers which may or may not appear later in published form.

Scientists chat together in small, informal groups during these meetings. Much is accomplished by this type of scientific give and take and it is an effective means of communication.

COMMUNICATION BETWEEN DISCIPLINES

Third is communication between scientists in different scientific disciplines as, for example, communication between physicists and biologists or between chemists and biologists or between biologists and psychologists.

There are an increasing number of interdisciplinary meetings stimulated by the realization that science is in grave danger of becoming compartmentalized.

Certain publications are having a signal effect in this also. These publications are devoted not to a specific field of scientific endeavor but to all fields, or to several fields which naturally depend upon each other.

In addition, and this is somewhat ancillary to the other three, there should be communication between scientists and the general public. I am sure that science would profit immeasurably if there were means by which the general public could come to understand the aims of science.

UNITED STATES INTERNATIONAL GEOPHYSICAL YEAR PROGRAM

I cite, merely as one example, something that has happened recently in the field of biology. Of all the 62 participating nations in the International Geophysical Year the United States alone has no organized biological program.

This is a result, I think, of the fact that the American people do not understand how biology fits into the spectrum of science and thus cannot understand why biology has a place in a geophysical program.

Probably more to dramatize this to the public than for any other one reason, the American Institute of Biological Sciences was instrumental in getting a young microbiologist into the Antarctic for a period of about 4 months. This was accomplished with the cooperation of our own Office of Naval Research, the Arctic Institute of North America, and the Virginia Polytechnic Institute, where he is on the faculty.

He is there now. Since the IGY projects of the United States had no place for him, we approached the Argentine Navy. We were able to get him aboard an Argentine naval icebreaker.

PENGUIN STUDIES

This young man is working in the Antarctic now on a problem of examining and classifying the intestinal microorganisms which occur in the penguin. He is, stated boldly, studying penguin dung.

When this is related to the average person much amusement and considerable scorn is evoked. I must admit that I cannot get very upset with the people who are so amused. The value of a man's spending his time examining penguin dung would appear to be strictly limited.

CONNECTIONS WITH HUMAN DISEASE

However, let us look into this a bit further. There is evidence to support a theory that some organisms which cause certain respiratory diseases in humans are transmitted by birds.

Now the interesting thing is that the species of birds suspected of carrying these organisms spend a portion of the year on the Antarctic Shelf. Just these additional facts then put an entirely different perspective upon why this young man is now in the Antarctic.

Obviously the penguins might well be a constant source of infection for the birds which carry these respiratory disease-producing organisms.

In this context, therefore, the thought of a young man spending 4 months studying penguin dung is no longer particularly amusing. Certainly, the value of the project is obvious. This lack of communication between scientists and the general public is serious for it is science that suffers.

BULK OF INFORMATION ONE PROBLEM

Returning to the matter of publications, which I have indicated in my opinion are the most important means of communication between scientists.

Communication by means of publications is gradually becoming less and less effective. The principal reason for this—in other words, the principal barrier—is simply the sheer bulk of published material that is now appearing.

Let us take only the field of biology as an example. In the life sciences—biology, medicine, agriculture, and other associated disciplines there are estimated to be 23,000 journals or periodicals in the world which are currently publishing some material on the life sciences.

ESTIMATE OF VOLUME IN BIOLOGY

The annual output of biological scientists through these journals runs close to a million articles per year. Parenthetically, I should like to add here that in that 23,000 figure it is estimated that some 1,800 of them go broke every year, but another 2,200 or so get established, so we are not making much progress.

Just the overwhelming number of articles being published is the barrier to effective communication. Coupled with this are the lag in publication which in some journals is now as great as 2 years, the increasing cost of publishing conventional journals, and, of course, the language barrier.

The publishing and distribution of scientfic articles is one of the most critical scientific problems which has to be solved, and it must be solved.

What can be done to alleviate this situation? I doubt very much that the number of journals can be reduced significantly. To repeat, the output of the scientific community throughout the world totals now about a million articles a year in biology alone. A reduction in the number of outlets cannot really be made when the number of published articles remains the same or increases.

CHEAPER PRINTING METHODS

We must rather investigate means by which these journals can be printed more cheaply and efficiently and how the information in them may be placed in the hands of potential users.

The publications committee of the American Institute of Biological Sciences has been interested in these problems for almost 8 years. It has vigorously pursued certain projects designed to increase the effectiveness of publications in the biological sciences. Some of these follow.

SUGGESTS NEW MEDIUMS

First, new mediums for rapid publication of scientific papers must be devised. A weekly biological newspaper has been proposed. Significant articles would appear in digest form only—the complete text of the paper would be available upon demand in mimeographed or other inexpensive form.

Second, existing technological gadgets and processes should be used whenever practicable. Microfilm, microcards, microtape, and similar processes should be used to speed publication and streamline distribution of scientific articles.

Third, abstracting services must be expanded. Biological Abstracts now does an excellent job, but because of financial restrictions is limited to about 25 percent coverage.

INFORMATION CENTER

Fourth, additional means of disseminating scientific information in capsule form must be devised. I might suggest the establishment of a center which would disseminate only lists of article titles and authors to all practicing scientists in this country.

Nevertheless, if all of these things are done the problem of communication by the printed word will be only partially solved. The scientist will still be faced with an appalling amount of material first to search out and second to read and digest.

MACHINE SEARCH

There must be designed a mechanical searcher of literature. The engineering of such a machine would be relatively simple. The intellectual problem of devising an index coding system is far more complex. An index code incapable of directing the machine to extract all pertinent information from storage may be more dangerous than no code at all.

But an efficient code and machine will relieve the scientist of the now staggering task of searching the literature and will provide him with many extra hours of scientific research productivity.

REVIEW PUBLICATIONS

There is yet another way of predigesting the literature for the practicing scientist. Review articles: Certain people have a knack of studying a body of literature, synthesizing it, and writing comprehensive review articles.

To the harried scientist, such an article is invaluable, particularly in an adjacent area of knowledge an understanding of which may be essential to him in his primary field of research interest.

One might consider establishing a program to finance the writing of review articles in all the major scientific fields. This should be a continuing project since these articles must be brought up to date periodically.

SOVIET TRANSLATIONS

I have purposely separated the matter of Russian translation from the above-listed proposals because I feel it is a problem of a different order. There are several excellent projects now in existence in biology, physics, and other fields.

The American Institute of Biological Sciences has a project in translation of Russian biological periodicals now in its second year. This project is supported by the National Science Foundation.

The National Institutes of Health and other agencies similarly sponsor translation programs. These have been well received by the scientific community and undoubtedly these programs should be expanded manifold.

There are many textbooks and reference works which should be translated. On the other hand, translation programs are costly and probably cannot be maintained at the required level forever.

RUSSIAN LANGUAGE STUDY URGED

Students in science should be stimulated to learn the Russian language as a research tool. General university acceptance of Russian as a tool language for the doctorate degree in science would be the first step.

However, universities should be supported in establishing departments of Slavic languages and, at least for the immediate future, science students might be offered scholarships or fellowships to study scientific Russian.

WARNS OF GIANT NATIONAL CENTERS

I have one word of caution which applies to virtually all of these proposals. Gigantic national centers—federally supported and federally controlled—are not necessarily the most effective ways of getting these things done.

There are now in existence many organizations which are doing many of these things on a reduced scale efficiently and expeditiously. These organizations are supported by the scientific community and have the experience and the know-how.

Being controlled by the scientists themselves, these organizations are able to interpret the needs of the scientists and can devise ways to satisfy their requirements.

A national center for abstracting may be pointed to with pride as a monument to the Nation's concern for science, but its product may not be as valuable to the working biologist as that of a smaller and less pretentious organization set up and administered by other working biologists.

The biologists of this Nation, at any rate, and in my opinion, are deeply concerned that the present upsurge in public demand to do something in science will result in ill-conceived, ponderously operating agencies which cannot do the jobs that must be done.

SCIENTISTS MUST ADMINISTER SCIENCE PROGRAMS

That is not to say that Federal financial support is not needed to initiate certain of the proposals enumerated above. It is my opinion, however, that the policy control and direction of these projects must be placed in the hands of the practicing scientists through their constituted organizations. This is essential.

The scientists themselves know what their requirements are and can evaluate the effectiveness of the solutions that may be devised.

The participation of these scientific groups insures that all areas of science benefit. Science is a continuum and all disciplines must advance together.

Techniques for the dissemination of information must meet the requirements of biologists, physicists, geologists, psychologists—in short, all scientists, because all are concerned in the scientific program of this country.

The placing of a satellite in orbit has as one major objective the placing of life in a satellite. The engineering efforts must be directed toward eventual support of life in a satellite. Many biological problems must be solved.

The first experiments must be simple ones which will yield a maximum of data from an experiment occupying a minimum of space in the satellite.

YEAST CELLS IN UNITED STATES SATELLITE

Biologists have designed such an experiment which could be included in the satellites which the United States plans to launch. These experiments necessarily must utilize at first the lowest forms of living things as, for example, yeast cells.

A culture of yeast cells can occupy a relatively small space and yet yield significant data on the performance of living things in an invironment of essentially no gravity.

Biologists must be included in all scientific endeavors that are to be undertaken by this country. It would be folly to exclude any of the basic fields of science from an overall program of developing science in this country.

EXPERIENCE WITH SECURITY SYSTEM

Mr. Moss. Dr. Cox, I note in your statement that you make little comment on some of the items which are of basic concern to the committee, in its study of the availability of scientific information.

Have you had any experience with Government security systems or the problems connected with them?

Dr. Cox. My experience has not been as extensive as that of Dr. Brode and certain others who have appeared before this committee. My agency is not a Federal agency.

On direct and personal result of security clearance I might cite.

We administer advisory committees to various Government agencies in the matter of how they should invest their research funds. Because some classified material comes up before these committees, I have been cleared as have certain members of my staff. This has require duplicate clearance for the same committee and myself, which advises two or more Government agencies.

BASIC RESEARCH SHOULD BE UNCLASSIFIED

Mr. Moss. Do you think that the present security system is helping or hindering scientific progress?

Dr. Cox. Ideally, I feel, that all basic, fundamental research should be unclassified.

I will agree that the gadgetry, the hardware, as Dr. Brode has called it, is in a different category. On the other hand, the line where basic research stops and applied research begins is a very nebulous thing at best.

Mr. Moss. Would you agree with the recommendations of Dr. Berkner that this problem could best be solved by a board or a commission with broad representation from the military, from business, industry, and science?

Dr. Cox. I think that is probably as good a solution as can be devised at this time. As I said, ideally, I would like to see no security classification, but I will admit that it is probably necessary that there be some.

Therefore, any system that would be devised that would eliminate multiple clearances and such things as that, I would say be the next best thing to no security classification at all.

Mr. Moss. How many clearances do you have?

Dr. Cox. I have two.

Mr. Moss. Because you work with just two agencies——

Dr. Cox. That have classified material.

NEED TO KNOW HINDERS SCIENCE

Mr. Moss. Do you believe that the need to know as it is used in Government is a valid standard for determining whether a scientist shall be allowed access to classified information like data on the missile program?

Dr. Cox. This goes back to my basic feeling, first, that I should preface everything I say in this field with the statement that my first choice is that there should be no security at all because we have more to gain from a free exchange of information than we have to lose from setting up barriers. Certainly I feel that the need to know, as I have seen and heard about it being practiced, should be greatly relaxed. Much of the information that appears now to be classified should not be classified, and is hindering, in fact, communications between scientists.

Mr. Moss. Do you feel Dr. Brode's recommendation that need to know be sharply modified to specific areas would be a considerable improvement over what we have now?

SECURITY LINES DEFINED

Dr. Cox. If the areas were based more or less along these lines—at the one pole is basic research and at the other pole is the hardware. I think the application could be applied in the case of hardware if it is essential to the defense of this country. I think it should be applied more there than at the other pole of basic research which I feel should be free.

THE BIOLOGIST'S ACCESS TO GOVERNMENT RESEARCH

Mr. Moss. Have biologists been afforded an opportunity to share in the results of classified Government research?

Dr. Cox. Actually the matter of security classification in biology so far is not the problem that it is in physics, and to a lesser extent I understand in chemistry. Biologists have not been included in the planning of the satellites, and such things as that. In that sense, then, they have been denied access to information. We feel that biologists should be included in such programs because the ultimate aim of any such program, or at least one of them, is getting man into a satellite. The same applies to any confined space in a submarine, for example. The matter of human performance in confined spaces is a very critical one. There is much evidence, for example—some evidence—to indicate that man, as serpents and other animals do, goes through a periodic cycle of performance. At certain times he is at his best, and at certain times he is not.

What effect the absence of gravity has, we don't know. The point is that these are biological problems, and the ones that the engineers will have to design their problems around.

LIFE IN EARLY SATELLITES

Mr. Moss. You indicated in connection with satellite experiments there should be some living thing in the satellite.

Dr. Cox. Eventually.

Mr. Moss. Is the biological scientist being consulted now by the Government in this area?

Dr. Cox. We are being consulted through this organization. We have a committee advisory to the Office of Naval Research. The project chairman of the space biology program in the Office of Naval Research, who is Dr. Sidney Galler, is in almost continuous contact with us. We have a committee which is advisory to them.

Yes, we are being considered more than we were before October.

Mr. Moss. You also mentioned the experience the young biologist had in trying to work with the International Geophysical Year projects in the Antartic. As I recall that is also under the general jurisdiction of the Navy, is it not?

Dr. Cox. Parts of it are. I believe the IGY committee is in the National Research Council. I am not being critical of the IGY committee because, basically, I feel it is the fault of the biologists because we have not sold ourselves.

Mr. Moss. Have you had the opportunity to sell yourself?

UNITED STATES BIOLOGY PROGRAM LAGGED

Dr. Cox. Yes, we have to a limited extent. As regards biological participation in the IGY it was pointed out to the IGY office as early as 2½ years ago that we were lagging behind in the matter of biological programs, whereas the Soviet Union, and all other participating nations, did have one.

Mr. Moss. Do I understand you correctly on this: We are the only nation of the 62 participants in the IGY which has not recognized biological science?

Dr. Cox. That has no organized biological program attached to it, that is right.

Mr. Moss. Are you familiar with the monthly list of Russian acquisitions published by the Library of Congress?

Dr. Cox. I know of it. I am not sure what "familiar" means.

TRANSLATION PROGRAM INADEQUATE

Mr. Moss. Is it your feeling that this Government is translating enough material from foreign scientific publications?

Dr. Cox. No, sir. Certainly not in the fields represented by the organization to which I am attached. We are publishing three journals in our fields of biology, cover-to-cover translations. We are in our second year. I would say as a minimum there should be 15 journals in the biological and agricultural sciences that should be translated cover to cover.

Mr. Moss. You indicate a little concern over the proper role of the Government in stimulating a large program of translation and of abstracting and indexing. Do you feel that a recommendation of Dr. Berkner that a central coordinating agency be created would be a desirable course?

GOVERNMENT SHOULD COORDINATE

Dr. Cox. In my opinion, that is the role that the Federal Government should play, in coordinating and bolstering up the activities that are now under way and bringing them up to the standards that the scientists find desirable.

Mr. Moss. Should we have all-out research programs to develop better modes of coding of abstracts and the necessary mechanical devices for the storing and retrieving of this information?

Dr. Cox. Yes.

Mr. Moss. Would you classify that as a very urgent problem?

Dr. Cox. I would classify that as the second most important thing I have touched upon, but second by only a very narrow margin to shoring up our present publications and streamlining the distribution of them.

Mr. Moss. In the shoring up process is it your view that that can best be done through subsidy to existing publications and organizations?

Dr. Cox. Where that is necessary. The journals in biology, of which there are quite a number, the journals in this country are becoming quite concerned with their own inadequacies and are doing

many things to improve themselves. Most biological journals are small and have a circulation of two thousand or less, maybe up to 1,500. This makes the cost of printing and distributing them very high. Any increase in any of the raw products means a big increase in the publishing of these journals. The journals voluntarily are getting together into groups to take advantage of mass production of journals, still retaining the identity of the journal. Biological editors are quite aware of this, and are doing things, themselves.

Help in some of these projects—by that I mean subsidy—in pushing along some of their projects would be about the wisest way to invest Federal funds at this time.

Mr. Moss. Why are there so few subscribers to each of the many biological journals?

CHAOS IN BIOLOGY

Dr. Cox. Well, biology is probably the most chaotic of all scientific fields, although quite a bit of order is coming out of it in recent years. There are at least 60 professional societies in biology in this country, each representing a little field of biology. Not just botany, because there are some 30 journals in botany. Probably it is because biologists started out to be taxonomists, classifiers. They tend to break themselves down into classifying units. Some of the biological societies that publish journals have 150 members. This would be the 150 interested in some esoteric field of biology.

What the biologists are becoming aware of is the necessity to unify. This has come about considerably in the last 2 or 3 years. The answer is simply that biology is made up of a lot of little fields.

Mr. Moss. I would like to ask your views on the steps necessary to bring about an improvement in the flow of scientific information. Let us take three steps in the order of priority you would give them. What would be your first one?

Dr. Cox. I think I touched on that briefly a minute ago. My first priority would be the improvement of existing journals and making them more readily available, reducing the time lag in publications, and things having to do with existing means of communications.

Mr. Moss. I was thinking more of the steps which Government might take to assist in bringing order out of chaos.

STEPS THE GOVERNMENT SHOULD TAKE

Dr. Cox. First, I think the Government should consider investing support in the existing—put it this way, in the existing journals as to how they can become more efficient in doing their job.

Mr. Moss. Subsidy?

Dr. Cox. Secondly, the matter of abstracting in biology is a critical one, and that Government support of the existing organization of biological abstracts would be money well spent. I would list that as second priority by a very small margin.

Third, and this would be along the lines of Dr. Brode, I think the stimulation of basic research in science and production of new scientists through the matter of Federal research grants.

Mr. MITCHELL. There was some publication some time ago about the Air Force sending a man up in a balloon. That touched on the field of biology. Has that information been made available to the biological societies?

Dr. COX. Not to my knowledge; certainly not through this organization or its publication.

Mr. MITCHELL. Is it still classified?

Dr. COX. I cannot answer that.

Mr. MOSS. I think Mr. Coll of the committee staff has a few questions, Dr. Cox, he would like to direct to you.

SHARK-REPELLENT DATA CLASSIFIED

Mr. COLL. Dr. Cox, I understand you attended a meeting yesterday on shark repellent?

Dr. COX. Yes.

Mr. COLL. Before you went to the meeting were you under the impression that the information on shark repellent that the Government had compiled was classified?

Dr. COX. Yes.

Mr. COLL. Did that turn out to be true?

Dr. COX. Not entirely. A portion of it is classified, and a statement was made that all material concerning shark repellents prior to 10 years ago is now declassified. Whether that is true or not, I don't know. I have not had a chance to check.

Mr. COLL. Prior to 10 years ago?

Dr. COX. Yes.

Mr. COLL. In other words, all materials on shark repellent from 10 years ago to date——

Dr. COX. No; prior to 10 years ago.

Mr. COLL. Was any reason given why this was so?

Dr. COX. I did not determine.

Mr. COLL. The classification presumably was made by the Pentagon?

Dr. COX. To my understanding, yes. And it had to do, I am told, with the list of occurrences of shark attacks.

Mr. COLL. Presumably that would be a Navy matter?

Dr. COX. Presumably.

Mr. MITCHELL. Can you conceive of why shark attacks should be classified?

Dr. COX. I don't know. This is a field into which we are going. Actually the meeting concerned a symposium that we propose to hold, a nonclassified symposium on, shall we say, the state of the art of shark repellents as of now. This will be held probably during this next year.

Mr. MOSS. Are there any additional questions? Mr. Carlson?

Mr. CARLSON. No, sir.

Mr. MOSS. Dr. Cox, we want to thank you for your appearance here today. It has been very helpful to the committee.

Dr. COX. Thank you very much.

Mr. MOSS. The subcommittee will now adjourn until 10 o'clock to morrow morning.

(Whereupon, at 12:05 p. m., the subcommittee adjourned.)

AVAILABILITY OF INFORMATION FROM FEDERAL DEPARTMENTS AND AGENCIES

Part 15—Restrictions on Flow of Scientific and Technological Information

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WEDNESDAY, JANUARY 22, 1958

HOUSE OF REPRESENTATIVES,
SPECIAL SUBCOMMITTEE ON GOVERNMENT INFORMATION
OF THE COMMITTEE ON GOVERNMENT OPERATIONS,
Washington, D. C.

The subcommittee met, pursuant to adjournment, at 10 a. m. at the George Washington Inn, New Jersey Avenue and C Street SE., Hon. John E. Moss (chairman) presiding.

Members present: John E. Moss, Dante B. Fascell, and Clare E. Hoffman.

Also present: John J. Mitchell, chief counsel; Samuel J. Archibald, staff administrator; Paul Southwick, professional staff member; Robert F. Coll, investigator; Ralph Widner, staff assistant; and Jack Howard, staff assistant.

Mr. Moss. The subcommittee will be in order.

In continuing our study of scientific information, we have as our witness this morning Dr. Warren Weaver, a mathematical physicist, vice president for the Natural and Medical Sciences for the Rockefeller Foundation.

Dr. Weaver is a trustee of the Sloan Kettering Institute in New York City, a member of the board of directors of the Council on Library Resources, and a former president of the American Association for the Advancement of Science.

I think it would be of interest to the members of the committee to know that wherever we contacted men of science for advice on these hearings, we were, without exception, referred to Dr. Weaver as being the foremost expert on scientific information.

And it gives me a great deal of pleasure, Dr. Weaver, to have you here to advise the committee this morning.

Dr. WEAVER. Thank you, sir.

Shall I proceed?

Mr. Moss. Would you proceed with your statement?

STATEMENT OF WARREN WEAVER, VICE PRESIDENT, ROCKEFELLER FOUNDATION

Dr. WEAVER. Mr. Moss, if I may, I would like first to read into the record a statement which I have prepared. Then, I would like to amplify this with some extemporaneous remarks.

A Subcommittee on Government Information, with a special interest in science, must concern itself with two main aspects—with communication between scientists and scientists, and with communication between scientists and the public.

I propose to comment on each of these two problems. Because of obvious restrictions on time, I will be able to do not much more than provide an outline of points which seem to be important.

At the outset, I would wish to say a precautionary word about the nearly exclusive emphasis here on science. It is of course clear that science is a vastly important enterprise. We all realize that we do not wish to and that we dare not neglect it.

The concern of each one of us is that, as individuals and as a nation, our lives be characterized by safety and comfort, to be sure, but still more importantly by beauty and by goodness.

A good many persons, especially if they are not scientists, think that science is doubtless essential for safety and comfort, but irrelevant to beauty and goodness.

I do not at all agree. I believe that science makes large contributions to the esthetic and moral aspects of life; and that it could make far greater ones if more people only knew what science really is.

AVOID OVEREMPHASIS ON SCIENCE

Other fields of activity, however, do admittedly contribute more directly and more importantly to beauty and goodness. And since safety and comfort are but shallow goals unless beauty and goodness are also present, we must be certain that, in our frenetic excitement over certain recent events, we avoid hasty and ill-advised overemphasis on science alone.

Thinking for the moment only of the relation of science to our capacity to defend ourselves, we can recognize the vital magnitude of that relation without forgetting that, as an even more fundamental task, we must assure that we continue to have a national way of life which, in the worth of its culture and in the nobility of its ideals, deserves defending.

It is a good thing that we have been shaken out of our complacency—that we rudely realize that we misestimated affairs.

SOME SECURITY RULES SELF-DEFEATING

In an article which I wrote recently I said:

> Granting that it is a new world, what do we do about it? * * * Do we change the self-defeating "security" regulations which impede our scientific progress, which confuse and alienate our friends of the free world and which must amuse—but certainly cannot hinder—our enemies? Will we at last face the fact that defense depends intimately upon our total scientific strength? Realizing that nature freely speaks all languages to all men, will we finally admit that basic scientific truths cannot be concealed by regulations? Will be recognize that, in the realm of pure science, you cannot keep a secret—that all you can hope to do is to keep ahead? (Quoted from Christmas 1957—And a World Encircled, by Warren Weaver, Look, December 24, 1957.)

We have indeed been shaken; and now we must be careful that, in our anxiety to respond, we do not illustrate the old couplet, "When in trouble, when in doubt, run in circles, scream and shout."

ADVOCATES A CAREFUL APPROACH

It is necessary to consider the items of highest priority for our resources, and to be thoughtful and careful at the same time that we are eager and anxious. Perhaps most of all, here in America, we must avoid the tempting illusion that we can remove just any difficulty whatsoever if we only appropriate a hundred million dollars.

Although the most important thing that ever happens in science happens inside the head of one man, it is nevertheless absolutely essential to a general scientific development that scientists communicate with one another.

With the modern fragmentation of learning and the intensification of rather narrow specialties, this is today both more important and more difficult than it was in the past.

TWO MEANS OF COMMUNICATION IN SCIENCE

There are two main methods by which scientists communicate—by the printed word and by talking to one another. Let us devote a few moments to each method.

There are contradictory troubles about the printed word. First, and as a lesser difficulty, there are too few printed words on certain subjects. Printing and distribution are very costly in relation to the resources of the scientists; and society has, generally speaking, expected scientists to pay the costs of their scholarly publication out of their own pockets, presumably unaware of the purchasing power of the average professor's salary.

Thus, one definite and valuable thing that the Government could do would be to furnish through the National Science Foundation increased support for scientific journals, particularly in those areas of pure basic research, such as mathematics, astronomy, biology, theoretical physics, and so forth, whose journals do not benefit appreciably from advertising income.

In some of these fields costs have forced editors to so much concentration that the articles have become almost unintelligible; and it is increasingly difficult to publish the general reviews and the expository articles that would be so important as an influence to counteract the difficulties imposed by so much specialization.

TOO LITTLE AND TOO MUCH

But the more serious and contradictory trouble is that there are also too many printed words—hidden away in too many places, too difficult to locate, and written in too many languages.

Although there have been clever improvements of many sorts, the fact remains that there has not been a really major improvement, relative to the printed word, since the invention of movable type some 400 years ago.

In the year 1700 there were perhaps 300 serial publications in the world. A century later in 1800 the number was 10,000. By 1900, there were roughly 200,000; and by 1950 the number had increased to 600,000. Of this total in 1950, about 50,000 were scientific periodicals, containing nearly 2 million articles a year.

If we consider the total rate at which words are printed in the world, it turns out that 10,000 persons, reading steadily for 12 hours a day, could not keep up with the continuing task of giving this material even a fast preliminary single reading.

We build bigger libraries with more and more stack room; but we know perfectly well that we are licked. We have hold of the tail of a geometric progression of ratio larger than one; and if you remember your high-school algebra you will know that in such a case the only question about defeat is, how long can you stave it off.

SITUATION NOW CRITICAL

This situation has become really critical, and we must do something about it. Admitting the existing general worldwide scheme of the printing of journals and books, of locating these in all sorts of special and general libraries in all sorts of places, and of serving these with abstracts, bibliographies, review journals, and so forth—admitting all that, one thing we must do is to make this process more effective by introducing all of the wholly or partly mechanized methods of search, reproduction, and delivery that can be sensibly devised.

We have at our present disposal a vast array of extremely powerful techniques—electrical, mechanical, optical, and so forth—which could aid by minimizing or even removing many of the delays which at present block the scholar's access to the articles, books, references, reproductions of portions, and so forth, which he needs to see.

As part of this first task with the printed word, special attention should be given to the various indexing, abstracting, and reviewing services.

OPPOSED TO NATIONAL CLEARINGHOUSE

It is tempting to think of setting up certain large-scale clearing centers for scientific information, and it may well be the case that careful and competent study would lead to such a decision.

My own hunches, and they deserve no more serious name, ordinarily run against such large and formally organized efforts. They tend to become bureaucratic, topheavy, and sluggish. They tend to take the critical decisions out of the hands of the working scientists and to make mountains of busy work for the kind of individuals—seldom top quality—who are interested and willing to do that kind of work.

To the extent that such large-scale efforts are successful, they might make still more difficult the much more revolutionary changes that the situation really requires.

But these unusual times may require us to undertake such a task. A general service is furnished to Russian scientists by their All-Union Institute of Scientific and Technical Information of the Academy of Science of the U. S. S. R.

Nearly 10 years ago, our National Research Council turned down a plan for an International Coordinating Office for Science Abstracting—

on grounds of being quite without prospect of the necessary financial support, and on the further grounds that the first thing for the United States to do was to put its own house in order.

But times have changed, and we even have an enlarged view of what our house now is.

CLEARINGHOUSE SHOULD NOT BE UNITED STATES EFFORT ALONE

It seems unlikely to me that a great scientific clearinghouse ought to be set up as a purely United States effort. These problems are essentially international in character; and even in a divided world we ought to start on as broad a basis as is possible.

I have heard suggestions that a scientific clearinghouse be set up as a NATO effort. If it is in fact feasible to do it at all, this seems to me the best auspices presently available.

INTERNATIONAL INFORMATION CONFERENCE SCHEDULED

This problem, incidentally, ought to be greatly clarified, as will many other problems in the general field of your committee, by the International Conference on Scienctific Information which is being planned by the National Academy of Sciences and which will be held from November 16 to 23, 1958, in Washington.

In addition to such short-range efforts to make the best of an essentially bad job, we should be doing long-range research on the basic problem of the storage and retrieval of knowledge.

What should, in fact, be printed in journals and books? What should be recorded in master copies in a few key repositories? What should be sent, not as paper by mail, but by ultrahigh-frequency radio to reproducing receivers? What are the useful limits and procedures for microscopic and ultramicroscopic recording? How can all this written material be digested, analyzed, and classified in such a way that machine searching becomes useful?

Long-range and basic studies of this sort, which make not limiting assumptions whatever about the future use of conventional printed material, involve research that may, at the moment, seem very strange and impractical.

But looking into the future, and noticing what is happening in so many other fields that involve both complication and a great number of individual actions or items, it is easy to believe that an important role will be played, in the overall library function of tomorrow, by some adaptation of giant electronic computers.

Electrical memory organs are being designed ever larger in capacity, smaller in physical size, and more rapid in access.

PROBLEMS IN USE OF MACHINES

The logical flexibility and power of these devices are such that they can answer essentially any question which you can ask them. But here is the rub: You must ask them in their own language. You cannot cut up the issues of a scientific journal into fragments, store these bits of information in the machine's memory, and then come to it and say, "Please help me. I am interested in the interrelated roles of nucleic acid and proteins in the genetic behavior of viruses."

You have to ask this question in such terms that it is usefully answerable through a process of carrying out a series of scheduled logical steps which utilize the stored bits of information.

You could easily ask a machine, "Give me a reference to every page—of material stored in your memory, of course, which contains the three words 'nucleic,' 'protein,' and 'virus.' "

But the answer to that question would not be useful, for it would contain both too much and too little.

The job of translating discursive English—or any other natural language—over into "machine language" is one which we do not at present know how to do. Indeed we cannot be certain that this problem is solvable.

STUDIES OF LANGUAGE STRUCTURE PROMISING

But recently emerging studies of the statistical and of the logical structure of natural languages are headed in this exciting direction. At least, they will reveal a great deal, hitherto unknown, about natural languages. At the best, they will in addition furnish a base for revolutionary improvement in the whole process of storage and retrieval of knowledge.

The improvement in speed which could potentially be produced through the use of these electronic computers is such as to constitute not just a quantitative change, but actually a qualitative change.

It is, very roughly, as though you could send, simultaneously, to a half dozen of the world's greatest libraries, skillful messengers who could in your behalf consult the card catalogs, not about 1 card each second, but say 10 million cards each second.

There is some research of this sort going on now, but there is not nearly enough. I was myself a member of a Government committee, a couple of years ago, that tried to get only $50,000 a year to support research of this sort, but we did not succeed.

EXPERIMENTS ARE COSTLY

Actual pilot experiments in this direction are admittedly costly. In addition to interest in this area in the National Science Foundation, and in the Ford Foundation-supported Council on Library Resources, there is some excellent work in progress connected with the Patent Office and at the Bureau of Standards.

A few university groups are at work; but the area is, in my judgment, greatly undersupported and offers a really significant opportunity.

Just in passing, it should be mentioned that progress in this area of research involves, as a rather mild case in fact, the problem of machine translation from one human language to another; and the problem of a classification scheme, for the knowledge as a whole, which is capable of continuous readjustment to the developing relations introduced by new knowledge.

Before leaving the topic of improving our use of the printed word, something should be said that applies equally to the short-range and to the long-range aspects.

QUESTION NOT HOW BUT WHAT TO DO

For the essential present problem, in each case, is not "How can we do this or that clearly desirable thing?" The essential present problem is "What are the clearly desirable things?" It is strikingly true that

we have at hand or reasonably accessible the technical means to do practically anything. The sad truth is that we simply don't know what we ought to do.

Thus, in connection with the more limited problems of abstracts, bibliographies, indexes, and so forth, we do not know enough at present about how scientists actually use books and journals, or how they would want to use books and journals if other ways were feasible.

ANALYSIS OF PURPOSE OF PUBLICATION URGED

To consider another aspect, we have not, so far as I know, analyzed out the actual, and the proper, purposes of publication. To mention certain negative aspects of the problem, some articles are published to establish priority. Some articles are published merely as a sort of professional advertising, and the author writes several articles in several journals on the same subject, just as General Motors puts ads in a lot of magazines and newspapers.

Some short scientific articles are published solely because journals are so crowded that there would be many months of delay for a longer version. We do not really know, as yet, what forms of publication to use for various purposes.

What I am trying to say here is that we need a lot of study of an operations analysis type to find out, much more dependably than we do now, what the problems really are, before we rush into half-baked multi-million-dollar schemes.

PERSONAL CONTACT AMONG SCIENTISTS

The recorded word, however, will at best always remain a cold substitute for direct communication through personal contact. For some very curious reason there has been a particular reluctance in Government circles against spending money to permit scientists to travel to some common point where they may talk together.

It is almost as though these were viewed to be junkets for personal pleasure, to questionable conventions at which the old boys get far away from the hometown so that they can kick up their heels.

All I can say, and all I hope I need say, is that view must be held only by persons who never attended a scientific meeting, and by persons who have no understanding whatsoever of the role played in science by direct personal contact.

Legislators must safeguard the use of all public moneys, and they may have special reasons for being so suspicious that travel funds are likely to be abused in selfish or improper ways.

But I can assure you, on the basis of more than a quarter century of experience in administering travel grants for scholars all over the world, that this suspicion is not justified in the case of scientists.

I would most emphatically urge that the Government provide funds to enable scientists to attend international meetings, and I would most emphatically urge that in the budgets for the scientific activities within our own governmental structure, really ample funds for travel be provided.

The time has come to stop acting as though funds for scientific travel were dubious, to be somehow slipped through the accounting and approving process. If the responsible officials of our Government

are not willing to provide adequate funds for this purpose, they must be prepared to meet the consequences of intellectual isolation.

One of the most important, and to scientists one of the most baffling aspects of this problem of communication between scientists and scientists, is to be found in the restrictions which still hamper contacts between scientists in our country, and scientists in other parts of the world.

It should be said at once that the situation has considerably improved during the last year or two. For a period after the war the situation was, in my judgment, a national disgrace. We do not need to waste time or energy in recalling how bad things were.

OTHER CURBS ON TRAVEL

Now we have, as I say, improved a good deal. But I would like to suggest a few points which still demand reform. Those who do not bear the direct responsibility for Government action must be patient and reasonable with those who do, for admittedly there are practical complications that may not be apparent.

But there are difficulties which scientists simply cannot understand.

In 1955 an invitation was issued, with the approval of our Government, to the astronomers of the world to hold an International Congress of Astronomy in the United States in 1959.

But it seems that the relevant Government officials are now debating whether or not we will admit, to that meeting, astronomers from the mainland of China. Do we insist on being an international laughingstock?

RESTRICTIONS ON RUSSIANS

The matter on which I would like to comment next concerns certain of the regulations which apply to visiting Russian scientists. It would be naive and unrealistic not to recognize that scientific exchange with Russian scientists presents special considerations and special complications at the present time.

On the other hand, there are specially strong reasons, scientific and otherwise, why such exchanges should occur.

To scientists it is simply incredible that we set up arbitrary zones in our country into which a Russian cannot go. It is perfectly permissible, as I understand it, for a Russian scientists to visit the Massachusetts Institute of Technology, with its vast store of the most important activities in the physical sciences and in engineering, for MIT happens to be located in Cambridge.

But it is not permissible for a Russian doctor to visit the Harvard Medical School, because that is across the line in Boston; and Boston has been ruled out of bounds.

VISIT OF FIVE SOVIET SCIENTISTS DESCRIBED

This business is so queer and so unbelievable that perhaps I should give further examples. The organization with which I am primarily associated recently made arrangements for visits in our country of a group of five distinguished Russian women physicians and medical scientists.

Their plane arrived so late that they missed a train to Chicago. We hastily arranged for them to fly to Chicago. But it turned out that we had done an improper thing. It would have been perfectly proper for them to fly to Chicago if they departed from LaGuardia or Idlewild. But their plane left from Newark, and that region of New Jersey is forbidden territory.

When they were to leave Chicago for Madison, Wis., it was a lovely late autumn day, and it was suggested that it would be nice to drive them by automobile. But no. It was O. K. to fly, but going by auto involved passing through a prohibited zone.

At the end of their stay the United States woman doctor who had accompanied them wanted to have the group as her personal guests for dinner. She lives in Brooklyn, and that region is verboten. So she had to invite them to a restaurant in Manhattan, just across the river.

Now, if all this were part of a musical comedy laid in Upper Slobbovia, we would be amused. But, gentlemen, this is the way the Government of the United States is acting.

EXCEPTIONS MADE FOR ATHLETES

I do not have dependable official information, but I have the impression from what I read in the news that some sort of exception has been made for athletes in connection with the Olympic games, and for cartoonists in connection with a visit that a group of them propose to make.

Now, do not misunderstand me. I think it is absolutely first rate for us to welcome athletes and cartoonists. But what sort of a sense of value do we have if we make exceptions for cartoonists and high jumpers, and continue to be sticky about scientists?

Granted that the Russians have similar restrictions which they impose on our movements in their country, this sort of petty retaliation raises questions concerning our standards of national dignity. Is it necessary for us to throw silly little international spitballs, just because someone else does?

It may be necessary that visiting scientists from certain countries be subjected to a degree of supervision of their arrivals, movements, and departures which we do not think of imposing on other visitors.

But if this is indeed the case—and for myself I do not see why it need be—then should this not be handled entirely by the Government agencies which are equipped to handle and experienced with the handling of espionage?

Is it fair or proper or useful to introduce any of these supervisory controls into the world of scholarship, where they stand in such unpleasant contrast to the ordinary intellectual code of confidence and courtesy?

DELAYS IN ISSUING PAPERS, TIME LIMIT ON VISITS

There continue, moreover, to be irritating difficulties of delays in issuing papers, and arbitrary difficulties of restriction of time on visits. Thus, I know of a distinguished Russian protein chemist who wished to spend 10 weeks visiting United States colleagues, and who was—completely arbitrarily from his point of view—told that he could stay

3 weeks. This cut down his time so seriously that he had to almost rush through laboratories where he should have spent days.

I do not know whether these troublesome incidents are due to high policy or to low administration—to overmeticulous or overofficious attitudes of minor personnel.

EVIDENCE OR RUMOR?

One of the most baffling and foolish forms of these difficulties occurs when the machinery of a distant legation or embassy holds matters up on the basis of what is referred to as "derogatory evidence," but which is sometimes wholly unchecked rumor.

I know of a case in which the "derogatory evidence" was the vague knowledge that the person in question had talked at a Communist meeting. When an investigation was finally made, under outside pressure, it turned out that this person had indeed talked at such a meeting. He had talked against communism.

Our lack of sophistication and maturity, over the past few years in this field of scolarly international interchange, leaves us with a lot to undo, a lot of friendship and respect to regain.

It would be a wonderful thing if the Department of State would send firm word all down the line, to reach the smallest clerk in the farthest legation, saying, in effect: "We are big enough, both in power and spirit, to afford to be friendly, courteous, and prompt. Interpret the details of regulation, in the best American tradition, with plain commonsense. We are not afraid to welcome scientists—we are proud to."

PRESIDENT'S MESSAGE CITED

It is most gratifying that the President, in his speech of January 9, suggested a lively colaboration between our scientists and Russian scientists in certain undebatable areas where men are, just as men, pitted against nature.

One thinks at once of the virus diseases, cancer, heart disorders, malaria, certain of the plant diseases which limit the world's food crops, and so forth.

It is to be hoped that we can indeed exploit some of these scientific areas in which the interests of all human beings are so clearly common interests, aimed at the general good.

COMMUNICATION BETWEEN SCIENTISTS AND THE PUBLIC

This is a subject to which I have devoted a considerable fraction of my life's time and energy. And since I have very recently expressed my considered views on this subject,[1] perhaps I may be permitted to read into the record a short portion of the article in question:

> No longer is it an intellectual luxury to know a little about this great new tool of the mind called science. It has become a simple and plain necessity that people in general have some understanding of this, one of the greatest of the forces that shape our modern lives.
>
> We must know—all of us must know—more about what science is and what it is not. We must appreciate its strength and value, and we must be aware

[1] Science and the Citizen, by Warren Weaver, Science, December 13, 1957. See also Science and People, by Warren Weaver, Science, December 30, 1955.

of its limitations. We must realize what conditions of freedom and flexibility of support must be maintained for pure scientific research in order to assure a flow of imaginative and basic new ideas.

Without some of this understanding we simply cannot be intelligent citizens of a modern free democracy, served and protected by science. Without this we will not know how to face the modern problems of our home, our school, our village, State, or Nation.

Our daily lives are surrounded by problems with scientific implications. When do we—or do we not—consult the psychiatrist or accept a free shot of a new serum? How about vitamins, hormones, sleeping pills, and transquilizers? How about nutritional regimens and slimming schedules? How about the emotional and psychological problems of present-day children? How about birth rates, death rates, population increases, and food supplies? How about cigarette smoking and lung cancer?

How about secrecy in science? How about visas for foreign scientists? I was shocked recently to hear a well-informed scientist remark that if the disaster of war should come, one of our greatest handicaps would be the fact that our secrecy policy has separated us from our friends.

How about the support for pure science? Where should it come from and how should it be dispensed? How can we as a nation keep a healthy balance between pure science and applied science? How can we recruit and train enough good scientists and, at the same time, not interfere with the recruitment and training of enough good philosophers, businessmen, poets, doctors, musicologists, lawyers, theologians, and so forth?

How about the more scientific aspects of foreign technical aid? How about automation? How about nuclear power and weapon testing and radiation damage and induced mutations and the future genetic purity of the race?

How about medical X-rays? In Sweden every X-ray machine is standardized, and inspection is reported annually. Do you think we ought to have such regulations here?

Do you believe that there can be such a thing as a "clean bomb," or do you think that war is inherently dirty? For how long will it serve the common good for us to have a monster Government agency in the atomic energy field, which spends billions of dollars inside a protective wall of secrecy, sometimes treating the public as though we were all small children, too young to know or face the facts? Is this agency, using the power of its money, going to shift more and more research out of universities and into its own establishments; and what do university presidents—say a group in the Middle West—think about this policy?

What are the duties of a citizen in relation to the more scientific aspects of conservation of our natural resources? Do you realize that today we have to mine and process cooper ore that is only one-tenth as rich as that which we used 50 years ago; that we now bring iron ore from as far away as Liberia; that we used to obtain oil by drilling only a few feet, whereas now we drill wells that are literally miles deep? Where is our water going to come from, as the demands increase every day and the water table gradually sinks?

How about the many millions of dollars the Federal Government is putting into science through the National Institute of Health, the National Science Foundation, the Department of Agriculture, the scientific agencies of the branches of the armed services? Is this too much of our taxpayer money; or is it in fact too little? Is too much of our national effort in science being channeled through military agencies? Is the money being put in the right places, and for the right things?

Who, in a democracy, really makes the decisions, and how can the decisions, in a modern scientific world, be made wisely and decently unless the public does have some real understanding of science?

The challenge to know something about science, moreover, is by no means limited to these practical questions, important as they are. For if we restricted our interest to motors and drugs, to electronic computers and guided missiles, to radiation genetics and atom bombs, we would move step by ugly step toward a mechanized future in which the purpose of our lives would be nothing much more than a rather selfish sort of convenience and safety precariously posited on power.

It is therefore of even more basic necessity that we understand the deeper aspects of science—its capacity to release the mind from its ancient restraints, its ability to deepen our appreciation of the orderly beauty of nature, the essential

and underlying humbleness of its position, the emphasis it places upon clarity and honest thinking, the richness of the partnership which it offers to the arts and to normal philosophy.

* * * * * * *

The fact is that the average citizen tends to fear science, when he should, of course, learn about it, so that it can be an exciting intellectual companion and a useful servant. He tends to think that science is entirely mechanistic, and that its successes in the biological field depress the dignity of the inner man; whereas, as Robert Oppenheimer has said, he should "* * * have known that human life was far too broad, deep, subtle, and rich to be exhausted by anything the scientists would find out in his own field."

We must all learn to understand this great modern intellectual force, to utilize it properly so that it may serve our lives and enrich our appreciation of the world around us, to respect the abilities of science at the same time that we realize its limitations, to know enough about science to be able intelligently to meet the responsibilities of modern citizenship.

"I am strongly of the opinion," wrote Sir Edward V. Appleton, "that it is the scientist's mission not only to uncover nature but also to interpret his results to his fellow men. Scientific knowledge is itself neutral. It is the use that is made of it that is good or evil. Decisions concerning that use are not for the scientist alone. The layman must therefore make his own efforts at understanding. To assist him, the scientist must, in turn, be ready to leave his laboratory to act as a guide."

WIDE IGNORANCE OF SCIENCE

Although we live in a society permeated by science, it continues, at least in some quarters, to be considered a little queer to know anything about science. Some preachers give specially pious emphasis to the fact that they know nothing about science.

The man in the street is often emphatic that he just can't imagine what science really is, or what makes scientists tick.

The statesmen—even the ones who have to legislate about atomic energy and nuclear weapons—sometimes seem almost to boast that they are ignorant of science.

And yet it is so clear that in this modern world, science and politics are inextricably interrelated. One sees the whole unified picture in a single phrase—atoms for peace.

Now, suppose that you admit that, as a general proposal, it is in fact important that communication be improved between science and the public. What can you do about this?

THREE-POINT PLAN SUGGESTED

I suggest that you could do three things at least. First, you could assure that Congress give the National Science Foundation sufficient funds so that they could provide some special fellowships, probably of 2 or more years' duration, under which it would be possible to train a body of young men and women in writing, in journalism, in the techniques of mass communication by radio and television, and most especially and importantly of all, in science, so that they could serve our society by acting as a communication link between science and the public.

Second, you could furnish funds, through the NSF, with which the American Association for the Advancement of Science, the one scientific organization in the country to which belong a great mass—over

50,000—of scientists of all varieties, which could be used by that organization to activate a carefully developed plan they have for serving as a major communication link between the body of scientists and the people of our country.

Third, you could insist that those major agencies of the Government which are concerned with basic research—the National Institutes of Health, the Atomic Energy Commission, the Department of Defense, the Bureau of Standards, et cetera, et cetera—accept and discharge an enlarged responsibility to give intelligible and candid reports to the public about what they are doing.

Why does the Government itself not have one or more television programs which report to the public what the various agencies are doing in basic research?

I apologize, gentlemen, for the fact that this seems to stop at a kind of an abrupt point. When I wrote this statement originally, there was a third section, but I realized that I better throw it out, and the only thing I could do at the last minute was to use a pair of shears and cut at this point.

Mr. Moss. I assure you, Doctor, I have found it a most interesting statement. It did not seem too long at all.

Mr. Hoffman. Also entertaining, Mr. Chairman.

Dr. Weaver. Thank you, sir.

Mr. Hoffman. As well as instructive.

Mr. Moss. We are going to take about a 2-minute break to accommodate a request and then we will resume the hearing.

(Whereupon, a short recess was taken.)

Mr. Moss. The committee will now resume.

Mr. Fascell, have you any questions?

PROPOSED PUBLIC-RELATIONS PROGRAM DISCUSSED

Mr. Fascell. Thank you, Mr. Chairman.

Dr. Weaver, does the American Association for the Advancement of Science now have a public-relations program which is funded by the association?

Dr. Weaver. It has only, at least in my judgment, a minor activity in this field. When the AAAS was started over a hundred years ago, there was written into its charter that it had two fundamental purposes; one was to serve as a communication link inside of sicence, and the second was that it should serve as a communication link between science and the public. It has, I think, been effective largely in connection with the former of these two problems.

Over the last 10 years particularly there has been a strong movement in the AAAS to treat seriously the second half of the charter. Our primary difficulties—I say "our" because I happen to have been very much interested in this association myself—our primary difficulties have been two, and they are interrelated; that we didn't have the staff with which to go at this problem and we didn't have the money with which we could go at it.

This is one of the professional organizations until recently supported entirely by the dues of its membership. It can just about break even in its publication program and other activities through those dues.

AAAS EXPANSION IN TWO AREAS

Over the last few years, it has begun to expand in two directions that I think are very important. One is in the area of science education and they have set up an active program in that area with an excellent young man, Dr. John Mayer, directing it; and the association has now begun to have real impact on the problems of education in science in our country, particularly at the lower levels where, in my judgment, these problems are most critical.

The association wishes very much to set up a parallel program in the general field of information to the public. It has before it a set of explicit opportunities. This is not a program in the dream sense, so to speak, that perhaps if we had money and perhaps if we had personnel, perhaps there might be something we might do. This is a very real situation in which explicit opportunities are before the association at this moment.

USES TELEVISION SHOW AS EXAMPLE

Let me just mention one illustration. There is a very good science program on television which is known as Conquest. I think this is financially supported by the Monsanto Co.

When they started that program they came to the AAAS and to the National Academy and asked them if they would be willing jointly to sponsor this program; that they wished it to have real dignity and real scientific value.

Both organizations said yes, they would sponsor it. And if you saw the program last Sunday afternoon, you doubtless noticed that it was sponsored by the AAAS and by the National Academy.

But this isn't as meaningful a sponsorship as it should be. And the reason that it isn't meaningful, is that the AAAS simply doesn't have the manpower to put into this effort. The commercial sponsor has indicated that they are not only willing but anxious to have basic scientific guidance, in order that this thing be as good as possible, and that it serve the country in a general sense.

We simply do not have in the AAAS staff, the people to help them on it. So, at the moment, I am afraid I would have to say that the AAAS sponsorship of this program is a somewhat formal affair. I think it should be a real affair.

MANY FIELDS NEED PUBLIC SUPPORT

Mr. FASCELL. I am inclined to agree with you.

The thing that disturbs me about your suggestion is that if this is necessary in the field of science to obtain public understanding and acceptance, why isn't it true in every field of endeavor—for example in law and medicine?

Dr. WEAVER. I would be the first, sir, to agree with you. I do think that it is important that the public understand all these other great fields of human intellectual activity. It happens to be a very important segment of my scientific conviction that science isn't the only thing in life.

Mr. FASCELL. I understand. That was the very broad objective statement.

Dr. WEAVER. These other things are important. They don't happen to be the things we are primarily concerned with at the moment. I would be delighted to make a speech on this other subject on another occasion, sir.

Mr. FASCELL. No. I only used that for reference to get a perspective on the urgency of the problem, hearkening back to your own words, which are: "Do not let urgency stampede us into some half-baked proposition."

Dr. WEAVER. Right.

THE FIELD OF LAW CITED

Mr. FASCELL. Therefore everything ought to be tested on its own merits and in the proper perspective.

I know, for example, that particularly in the field of law, there is always the great problem of public understanding and acceptance.

This has been a very, very difficult problem. Yet I am aware that many associations at a local level have undertaken to use their own funds to improve their public relations, and to communicate with the people to achieve this.

I can think of no circumstance that would make it necessary to apply Government funds for this purpose. I can think of no circumstance at the moment that would make it necessary to use Government funds to achieve this understanding of the field of medicine.

Now you are suggesting that we do this in the field of science. I question this.

Mr. HOFFMAN. Will my colleague yield there?

Mr. FASCELL. Yes.

Mr. HOFFMAN. On pages 9, 11, 20, and 22 of his statement he asked for more money.

Mr. FASCELL. There may be a good reason for that, and he has delineated very clearly and analytically the case he presents. On this one point I just wanted to see if he could get some clarification.

Mr. Moss. Yould you yield to me at this point?

Mr. FASCELL. Yes.

THE ROLE OF SCIENCE

Mr. Moss. I find myself in agreement with Dr. Weaver that there are fundamental differences between the problems of law in relation to society and the problems of science. I would put medicine in the field of science, because I think it is a very important part of science.

Science today is increasingly a basic resource of the Nation. We used to look to other fields than science for the development of new horizons. Now we know that science is the base upon which we erect all of the new technology. Even the materials that we use, that formerly were natural materials, increasingly are synthetic materials. Science has even greater implications in the national defense.

Science produces weapons undreamed of just a few years ago. Public understanding of a field which has so long been divorced from the people requires greater emphasis than those areas of learning where the average person is on familiar ground.

RESPONSIBILITY FOR PUBLIC RELATIONS

Mr. FASCELL. In general, I agree with everything you have said.

Realizing the importance of science, there is still a question as to whether the responsibility of getting across science's message to the public isn't the job of the scientist.

Dr. WEAVER. Let me suggets to you, sir, a specific question: For 7 or 8 years now, the American Association for the Advancement of Science has been discussing the usefulness, and I mean the broad social usefulness, not just the scientific usefulness, of an extensive series of small paperbacked books which could be printed in large numbers and distributed at low costs so you could pick them up in the Washington Airport and people would read them, which would be written by first-rate scientists, and each one of which would attempt to give an exposition in generally understandable terms of what is going on in some field of science and what problems lie ahead in that field of science.

We have discovered that the scientists are willing to write such books if circumstances can be arranged so that this is mechanically possible for them.

We have discovered that there are publishers who are interested in this procedure. The total amount of money that is necessary to activate this plan is so many decimal points away from what you gentlemen are used to considering that I am almost apologetic for mentioning it.

AAAS HAD FORMULATED A PLAN

I think the AAAS would have to have a revolving fund in order to get this thing started of the order of fifty to a hundred thousand dollars, and it would have to have one person on its staff that could ride herd on this thing.

We have had this plan all ready to go for about 3 or 4 years and we can't start it. Why can't we start it? For the very practical fact that we haven't got the hundred thousand dollars, and we haven't got the man.

Where should this support come from? Do you say from the scientists; out of their pockets, out of the dues that they pay to the AAAS? Well, as a matter of fact, we don't dare increase the dues to the AAAS because we think we are just on the edge of diminishing returns on this. We don't want to make membership in the AAAS impossible or difficult for the young scientists. We think they are paying out of their own pockets as much dues as the society has a right to ask them to pay.

The simple fact is, we haven't got this money and we can't start the plan.

Mr. HOFFMAN. Would the gentleman yield to me there, if I tell you how to get it?

Dr. WEAVER. I would be delighted to know, sir.

Mr. HOFFMAN. Have your professors or whoever speaks for you write a little treatise on that. Get Mr. Moss to sponsor it. Put it in the Congressional Record. Get it printed at Government expense and as a public document and then later on add a little of your own material to it.

I don't know—Mr. Moss and you would decide whether he would want to have you as the author or whether he should write it himself.

Sell it as a pocketbook. That is the way we got our information about the Government. The library made a research study of the functions of our Government and thousands of copies were published at Government expense.

Then, Mr. Patman, our very learned colleague, revised it somewhat and it was put on the market, as a pocketbook at 35 cents, pictures and all. Many copies were sold—a fine treatise.

See how easy it was? I am not a scientist, just a fellow from the sticks. But that is one way to get what you seem to want. Just as easy as to roll off a log.

EXPLAINING SCIENCE

Mr. FASCELL. One of the most entertaining and interesting books I have read recently, which I read with our 10-year old daughter, is called "Our Friend, the Atom." This type of publication is printed more frequently and has become more available.

I am convinced that scientists are doing their job and are attempting to solve this public-relations problem. The reason I asked this question was to get the explanation you just gave for the record.

Now this becomes more basic. Public acceptance of the scientist means he can command the salary he should be earning.

If your general idea makes it necessary for us to do this, then by all means we must. This would be my own analysis.

VOLUMES ACCEPTED FOR WHITE HOUSE BY KILLIAN

Dr. WEAVER. This morning, just after breakfast, I looked at the last issue of the New Yorker and, gentlemen, it reported that the American Book Association has just made its annual gift of 200 volumes to the White House.

Among those 200 volumes there was not one that had anything to do with science, and perhaps it is slightly ironical that in the absence of the President, the 200 volumes were accepted by the White House by Dr. Killian.

This is partly funny and this is partly tragic. But I cite this simply to illustrate the fact that there is an awful lot to be done here still.

Mr. FASCELL. Let me divert here for a moment and get in a plug for philosophy. Dr. Weaver, don't you feel that at the root of most of our problems is our inability to communicate with each other?

Dr. WEAVER. Well, first of all, I have to confess that I am a confirmed optimist toward life in general.

Mr. FASCELL. So am I.

Dr. WEAVER. Secondly, I do not think the people are stupid. I do not think that they are incurious.

Mr. FASCELL. I don't either.

Dr. WEAVER. I think that the people are an awful lot brighter and an awful lot more curious and an awful lot more able, willing, and ready to absorb interesting and important ideas than some people assume they are.

Mr. FASCELL. This accounts for the large turnover in Congress.

Dr. WEAVER. So, I am——

Mr. HOFFMAN. What about those who stay here more than one term?

MASS COMMUNICATION INSTRUMENTS ADEQUATE

Dr. WEAVER. I am not really pessimistic, sir, about the capacity of the various instruments of mass communications to do this job. You see, actually, within the last 25 years there has been a tremendous improvement in what is being done in this area.

Take, for example, the one journal that I hope the majority of individuals in this room are acquainted with, the Scientific American. This is a remarkable piece of communication between science and the more literate level of the public.

That is what it aims at. It performs that particular function in a remarkably good way. There are a lot of people, however, who are not ready for the Scientific American. These are good people. These are part of the people who vote "Yes" and "No" on the basic issues that control our lives and our country.

I want to get a lot of this sense of science, this excitement of science, this beauty of science, this understanding of science across to all of those people. I believe it is possible.

Mr. FASCELL. I agree not only that it is possible but absolutely necessary.

SCIENTIFIC KNOWLEDGE A MODERN NECESSITY

Dr. WEAVER. I was quite serious when I said if you go back a couple of hundred years it was a pure luxury whether the average man of affairs knew something about science. He could have an intelligent attitude toward the problems he had to decide without knowing anything about science.

That isn't true any more. I don't think you can be an intelligent member of a free democracy at the present time without knowing something about science. And as a matter of fact, I think it is an element of dangerous instability in our democratic procedure that we do not have as much understanding of science on the part of all of the people as we ought to have at the present time.

My interest in this is not primarily the interest of the scientist. I happen to have devoted my own life to the scientific field. But my basic interest in this matter of public communication of science is not as a scientist but as a citizen.

I think this important to our country.

Mr. HOFFMAN. Will you ask him——

Mr. MOSS. Mr. Hoffman.

Mr. HOFFMAN. I don't quite understand that. I thought I heard you say that every American should know something about science.

Dr. WEAVER. This, sir, I repeat: I think every American ought to know something about science.

Mr. HOFFMAN. That might be desirable, but do you think every individual should give some study to it?

Dr. WEAVER. No.

Mr. HOFFMAN. To some science?

Dr. WEAVER. Perhaps there is a little misunderstanding as to what I mean he ought to study, what I mean he ought to understand.

Mr. HOFFMAN. That is what I would like to know.

PUBLIC SHOULD BE AWARE OF ROLE OF SCIENCE

Dr. WEAVER. I am not talking about a large amount of factual detail, of formulas or theorems of science. I am not even talking about a large amount of the actual factual results of science. This is not what I am talking about.

I think that every citizen ought to know, and I think it is possible for every citizen to know something about the role that science plays in modern life.

Mr. HOFFMAN. That it is a good thing. Is that what you mean?

Dr. WEAVER. I think that would be a good thing.

Mr. HOFFMAN. Not long ago we were out West with the committee, we learned that billions of feet of timber were left to rot or burn. Along came the scientists and I guess they used that waste or the timber that wasn't used before to make practically everything except I guess something to eat.

Maybe they have done that since we were there. I don't know. Many of the people in that community, I suppose had never heard the word "science," but they knew that someone had used superior knowledge to bring about those results which were beneficial to all of them.

They didn't know how it was done or they didn't have any schools where science was taught. They haven't the slightest conception as to how it came about.

You didn't mean that everyone should study so that perhaps he could do some of those things?

Dr. WEAVER. I am not trying to make scientists out of everybody. Let's be sure we don't misunderstand that.

Mr. HOFFMAN. We all realize that is an impossibility anyway. Take the average Congressman, you couldn't make him into a scientist. You would cry your eyes out.

Dr. WEAVER. I suspect that the converse theorem is also true, sir.

Mr. HOFFMAN. I doubt if you could make a scientist into a Congressman either that would be worthwhile, that is, too many of them. I don't mean all of them, of course.

Dr. WEAVER. Let me illustrate a little more concretely.

Mr. HOFFMAN. Just what you meant.

SCIENCE INDOCTRINATION IN HIGH SCHOOLS

Dr. WEAVER. I believe in almost every high school in our country there are courses on—what do they call it—citizenship?

Mr. MITCHELL. Civics.

Dr. WEAVER (continuing). Civics—something of that sort. Don't they exist in almost every high school in our country?

I would just like to risk the guess that in not 5 percent of these courses on civics or citizenship or the structure of what is going on in our country, is a word ever said about science. I think it should be.

Mr. HOFFMAN. They take physical education instead.

Dr. WEAVER. Wait a minute—physical education.

Mr. HOFFMAN. That is a specialty of the football and basketball boys.

Dr. WEAVER. That used to be gym, back in my days. That isn't what you are talking about?

Mr. HOFFMAN. I am serious about the matter.

Dr. WEAVER. We are equally serious, sir. We share exactly the same concerns. I haven't the slightest doubt that we share the same concerns.

Mr. HOFFMAN. Thank you, Mr. Chairman.

MULTIPLE CLEARANCE

Mr. FASCELL. Dr. Weaver, what are your views on the multiple-clearance system whereby each of the armed services has its own security standards?

Dr. WEAVER. I am a poor witness for you on certain items, and as I remarked just before this meeting started, it is part of the scientific code not to talk about something that you don't understand very well. Although I had a good deal of experience with clearance during the war, I have had almost no experience with it since the war.

In principle, the multiple system sounds to me crazy. To give you specific illustrations of the fact that it may or may not work out in a very inefficient manner, I am not prepared to do. But I surely cannot see why there should or need be separate procedure in different branches of the Government. This, in principle, seems to me so nearly incredible that I just in theory disbelieve it.

Mr. FASCELL. And the logical conclusion is that multiple clearance impedes scientific achievement?

Dr. WEAVER. I think without any question.

NEED TO KNOW

Mr. FASCELL. Do you think that the need to know is a valid standard for determining whether or not a scientist should be allowed access to classified information?

Dr. WEAVER. I am sure it is, if you will let me define "need."

Mr. FASCELL. All right, sir.

Dr. WEAVER. I think that is the crux of the business. Who is it that decides what "need" is? If this is in the field of pure science, the only tolerable definition of need is simply that the man wants to know. That is the only tolerable definition of need. He is curious.

The most basic and the best motivation that you ever get in pure science is curiosity, and if somebody just wants to know something, that is the most valid statement of need that you can get in pure science.

When you get up to the level of applied science, into the field of development, and when you are starting to build hardware, then need can be defined pretty explicitly with respect to the necessity of designing and producing that piece of hardware.

At that stage, I think the practical requirement furnishes a valid definition of need.

AREA BETWEEN PURE AND APPLIED SCIENCE

In between those two, in between the pure basic science and the man who is so specifically on the development stage designing hardware, there is an intermediate stage where the definition of need, I think, is

very puzzling and difficult and where I think the concept is acceptable, provided you interpret need very flexibly and very liberally.

THE TRANSISTOR

Let me illustrate again with a specific case. Suppose in the Bell Telephone Laboratory 10 years ago a group of young engineers had been assigned the job of improving the performance of vacuum tubes and had also been asked to see what they could do about making them smaller and smaller, and suppose that one of the most brilliant and imaginative members of that group came up with a statement that he wanted to know something about the special properties of certain germanium alloys. Just let's assume for the moment that that subject had some classification. And someone had come to him and said, "For heaven's sake, why do you need to know anything about the properties of germanium alloys when your jobs are to make better and smaller vacuum tubes? This sounds like nonsense to me and you can't have it."

But he would have been most gorgeously wrong. He would have been astronomically wrong, because the fact is that out of that kind of a group comes the research which leads to the transistor. This isn't a vacuum tube at all. But it does the job of a vacuum tube. And instead of being the size of a vacuum tube, it is a little less than the size of the eraser on your pencil.

This was a tremendous breakthrough in the whole technological field of communication.

NEED MUST BE LIBERALLY INTERPRETED

You won't get those breakthroughs if you have some dull person decide the definition of need for those people. This has to be liberally interpreted.

Mr. FASCELL. How long can a basic scientific discovery be kept a secret?

Dr. WEAVER. I can give you instances in which it wasn't kept a secret for, so to speak, a day. Just within the last month in two different scientific journals I have seen a very intriguing calculation of the lifetime of a satellite. The thing is up at a certain height; how long will it be before it plunges and burns out? How long will it stay there?

One of these calculations was made by an astrophysicist down in southern Africa, published in one journal. Another one was made in England by another scientist, published in another journal. They came out the same week.

This is not a good example of a basic discovery of world-shaking importance from the point of view of defense or anything of that sort, but what I am saying is that when the whole body of science moves forward all over the world, these things break in general at about the same time everywhere.

SIMULTANEOUS DISCOVERY A FACTOR

I even know of an example several years ago where one problem was being very eagerly discussed; and a solution of it appeared simul-

taneously in five journals. Generally speaking, science moves forward on a common front and what that means is that, generally speaking, a basic, a basic discovery can't stay hidden for any appreciable length of time.

Mr. HOFFMAN. May I ask him here——

Mr. MOSS. Yes.

Mr. HOFFMAN. If that is absolutely true we ought to have that sputnik pretty quick.

Dr. WEAVER. Sputnik did not involve a new basic scientific discovery. This is a technological development.

Mr. HOFFMAN. I didn't know the difference. I thought you meant a basic discovery is apt to break throughout the world at the same time.

Dr. WEAVER. I am saying that this occurs more or less at the same time.

Mr. HOFFMAN. Then we should have a sputnik pretty quick.

Dr. WEAVER. Let me see if I can answer this sensibly and usefully. We knew how to put——

Mr. HOFFMAN. My scientific friend, Mr. Moss, says basic rather than applied.

UNITED STATES HAD KNOW-HOW TO LAUNCH SATELLITE

Dr. WEAVER. All right, let's expand that just slightly. The fact of the matter is that we know how to put a satellite up in the sky.

Mr. HOFFMAN. You are getting back to saying that Congress didn't give them the money.

Dr. WEAVER. No. I say we have known how to do it for some time. The Russians have known how to do it, the British have known how to do it, everybody has known how to do it.

There is no basic scientific theory that has been missing in ours or any body's minds. It just didn't seem important to us for a variety of reasons to do that particular piece of development, that is all.

Mr. HOFFMAN. That is clear.

Dr. WEAVER. We know how at the moment to build an automobile twice as long as any automobiles we have.

Mr. HOFFMAN. And take up twice as much parking space.

Dr. WEAVER. We are not building them because they are long enough as they are.

SATELLITE NOT PRIME OBJECTIVE

Mr. HOFFMAN. We didn't have the Sputnik because that wasn't our first objective.

Dr. WEAVER. That is true. I think there is no question about it. We didn't give that a high priority in the field of development.

Mr. HOFFMAN. The things we did give priority to, were they more important than the launching of the sputnik?

Dr. WEAVER. I don't think I am qualified to answer that question.

Mr. HOFFMAN. How in the world do you expect a Representative to answer it then, or anybody in the Defense Department for that matter?

Dr. WEAVER. I think I could answer that question, if for the past 5 years it had been my responsibility to be informed about all the alternatives.

Mr. HOFFMAN. You mean Monday morning quarterbacking?

Dr. WEAVER. If it had been my responsibility to be informed about the alternatives over the past several years, then I would feel it my moral and intellectual duty to answer that question.

I don't know what the alternatives are so I don't have the basis for answering that question.

Mr. HOFFMAN. Thank you, anyway, for the opinion.

SCIENCE A GROWING POLITICAL FACTOR

Mr. FASCELL. One thing is clear, is it not, that science, basic or applied, has become a very important factor in world affairs?

Dr. WEAVER. It certainly is.

Mr. FASCELL. And this includes politics as well as science?

Dr. WEAVER. I think it is quite clear that we underestimated the desirability of getting one of these little hunks of metal up there. I think we underestimated that. I think this was a mistake.

I am not so sure that this is so much a scienific mistake as it is a mistake in other fields. This is a mistake in the field of international politics.

Mr. FASCELL. Policy.

Mr. HOFFMAN. Then, assuming that we might have done that in your opinion, but we didn't because we didn't attach primary importance to it, was it better to go along, for example, with social security, Federal aid to education and a dozen other social reforms and let the sputnik drift, the launching of it.

Dr. WEAVER. I know, sir——

Mr. HOFFMAN. If you were a Russian, which would you rather have, or an American now—the things we have had or the things they have had?

Dr. WEAVER. That is an easy question for me to answer, I would rather have the things we have.

Mr. HOFFMAN. Without the sputnik. If you couldn't have them all.

Dr. WEAVER. I am not quite so clear that these are the alternatives.

Mr. HOFFMAN. All right. Pardon me.

EARTH'S ELECTRICAL FIELDS

Mr. FASCELL. I read an article not too long ago, Doctor, dealing with a finding that the earth is encircled by three fields of electric energy, each of which was capable of producing a thousand amperes of power.

Are you familiar with that at all?

Dr. WEAVER. I am not.

Mr. FASCELL. Is that a basic scientific finding?

Dr. WEAVER. If substantiated, yes. It sounds screwy.

This, moreover, I am prepared to say, because it happens that my own field of scientific specialization is electrodynamics. So this is something I happen to know about. And as you have stated it, it sounds screwy.

Mr. FASCELL. Let me give you another example. If it developed that there is a magnetic force surrounding this planet which could be

harnessed as a basis of power, would that be a basic scientific discovery?

Dr. WEAVER. If substantiated.

Mr. FASCELL. Of course, I am assuming it would have to be substantiated.

Dr. WEAVER. Yes.

Mr. FASCELL. This is the type of discovery you would say should be freely available?

Dr. WEAVER. If, sir, the basic facts of nature are such that this is possible, those basic facts of nature are just as accessible to the people in Indonesia or the people in Russia as they are to the people in the United States.

Mr. FASCELL. Assuming that such a discovery were made and assuming further that the finding pertains to what we call unidentified flying objects, should this be a classified matter or not?

Dr. WEAVER. I can give you my own judgment as to where I think the line should be drawn.

Mr. FASCELL. Yes.

WHERE SECURITY LINES SHOULD BE DRAWN

Dr. WEAVER. I think it is not only feasible, I think that it is necessary, as a matter of national prudence to apply classification and security to anything when it gets to the hardware stage.

The design of specific devices, the techniques of production, the performance data—these, I think, are properly classified items.

BASIC FINDINGS SHOULD BE FREE

When you are dealing with basic facts such as the electromagnetic field in which the earth exists, and the relationships to the fundamental laws of electrodynamics, I do not think that such information is classifiable. I do not think you can succeed in keeping the secret, and I think you only hamper yourself if you try to.

Mr. FASCELL. One of the things that keeps confusing the issue of availability of scientific information is this:

Let's assume that American scientists have discovered a basic scientific phenomenon. They know that it can be applied almost immediately; the question is shouldn't we keep that basic scientific information top secret until such time as we can apply it to hardware before we give it to anybody—even our allies?

Dr. WEAVER. I am very glad you asked the question in such a pointed and specific manner, because I would prefer to walk right up to the line to be counted. I would print it.

Mr. HOFFMAN. You would what?

Dr. WEAVER. I would print it in the scientific journals of the world.

Mr. HOFFMAN. But not the know-how to do it?

Dr. WEAVER. Not the know-how to do it. The minute this thing goes into design, goes into hardware, the minute this thing goes into performance data, then I think this is classifiable.

This is not a position of idealism. This is a position I think simply of being realistic, because I think you can control the thing I am talking about controlling? And I am absolutely convinced that you can't control information about the basic truths of nature.

Mr. FASCELL. What attempts you do make to control are only impediments in your own way?

Dr. WEAVER. It keeps you back.

RELATION BETWEEN SECRECY AND DEFENSE

I think we are just passing into a new stage that we haven't yet quite matured to, particularly with respect to the relationship of security and secrecy to defense.

The older and classical military theory of security and secrecy was of course applicable primarily to the problem of controlling one human being to keep him from telling something to another human being.

And that type of security was effective when military strategy and military procedure was what it was, even in World War I, and certainly, let's say, going back to the Civil War. But now, science is the primarily important tool in military operations. And we forget that science results not from a conversation between two human beings, but from a conversation between a human being and nature. And the interesting thing is that you can't shut nature up.

Nature talks to the Russians. Nature talks to everybody. It talks perfectly freely to them. And we know perfectly well by this time that the Russians are very smart, don't we? We have gotten over this idea that they can't run tractors. So that we are in a completely new area of control, and we simply have to mature our ideas about secrecy and security so that they conform to the new situation.

Mr. FASCELL. Would you expand this discussion a little bit to include sharing of our scientific information, both basic and applied, with our allies?

EXCHANGE OF DATA WITH OUR ALLIES

Dr. WEAVER. I think I should only attempt to state an impression here, because I do not know the actual technical facts reliably enough.

My impression is that we have been reluctant about sharing our basic scientific facts with some of our best friends in the free world; to the extent that this is true, I think it is scandalous.

I mentioned in my written statement, I heard a very, very able and very experienced physicist say that if disaster should come, one of the most awful things is that it would turn out that we had to some extent weakened our position and weakened our relationship with the best friends we have by this procedure.

ELECTRICAL FIELDS

Mr. FASCELL. Doctor, getting back to this three electrical fields around the earth. I understand that this is a tentative finding of the IGY group.

Dr. WEAVER. It sounds more like Mr. Gernsbach than the IGY.

I heard a report from a group of the IGY people just Monday at the National Science Foundation meeting. I do know that they have already discovered some exceedingly interesting facts about the distribution of magnetic field about the earth which had been previously unsuspected.

This is true. This is very exciting. This is the sort of thing one would hope to come out with.

Mr. FASCELL. I probably described the wrong thing to you.

NEWSPAPER COVERAGE OF SCIENCE

Dr. WEAVER. If you will permit me to reintroduce another note—and the press won't misunderstand me on this particular point, for my son happens to be a newspaper reporter and I am wholly sympathetic with the problems of the fourth estate—you may have had the bad luck of reading a story about it in the newspaper written by somebody who didn't know anything about science.

Mr. HOFFMAN. Oh, no.

Mr. FASCELL. You mean I became an accessory after the fact?

Dr. WEAVER. I am sure you will interpret this remark as constructive. What I am trying to do is get back to this idea that scientists ought to build themselves into much closer relationships to the press people, and we ought to provide means whereby a much larger group of men involved in the active work of the press could know more about science so they can interpret it better to the public.

This is an instance of poor public interpretation of science. I don't think it is their fault at all.

VOICE FROM PRESS TABLE. Does the press get a chance to defend itself?

Mr. MOSS. It would be a somewhat of a departure to permit it at the moment.

Mr. HOFFMAN. They don't need a defense.

Dr. WEAVER. The Chairman must forgive me. I didn't mean to introduce an irrelevant note.

Mr. HOFFMAN. That won't be the first one if you did. Not on your part but ours.

PRIORITIES ASSIGNED TO SCIENCE ASSISTANCE

Mr. FASCELL. In your statement, you mentioned a question of priorities. How would you assign priorities for increasing the flow of scientific information from the Government?

Dr. WEAVER. The first thing I would do would be to assure a reasonable amount of support for a number of agencies which already exist, which already are doing a decent job but which are seriously handicapped just by this crude fact of money.

STRENGTHEN EXISTING INFORMATION CHANNELS

As a second line of priority, I would try to see to it there were sufficient money for studies of what we ought to do next. Again I would urge working through existing agencies, and the principal ones I think would be the Information Division in the National Science Foundation, and the group under Dr. Wally Atwood out at the National Academy, in the field of international scientific communication.

I have very great reluctance to see us burst forth with something dramatic and big and novel before we know what we ought to do. I also think that this is also unfair to a series of really good agencies we have existing now.

Mr. FASCELL. You are talking about collecting and disseminating scientific data from all over the world.

Dr. WEAVER. Yes.

I think sometimes when we get ourselves in the sort of situation we are all in at the moment, namely, deeply concerned about the state of the world, there is a little tendency to feel that the only thing that will satisfy us is to do something dramatic, big, and new. Sometimes of course that is required.

But I don't think we should forget that we have in the Government some absolutely first-rate agencies to work with at the present time.

FIVE LINES OF ASSISTANCE

I think one of the first things to do is to see to it that we back and use Dr. Killian, rather than that we try to think of something else.

Secondly, I think we should back and use the National Science Foundation.

Thirdly, I think we should back and use the National Academy of Sciences and the National Research Council.

Fourthly, I think we should back and use Dr. Brode, who has just been made adviser to the State Department for Science.

And fifthly, I think we should back and use the American Association for the Advancement of Science.

These are all existing agencies and they all have the complete confidence and respect of the scientific community. They have first-rate people in them.

I think we can do a very large fraction of the things we ought to do with and through those agencies if we really back them.

Mr. FASCELL. I think you have been a little modest. How about backing and using Dr. Weaver?

Dr. WEAVER. I would rule that out as being irrelevant.

Mr. MITCHELL. Mr. Fascell, would you yield for a moment to me?

Mr. FASCELL. Sure.

Mr. MITCHELL. Mr. Coll and myself had the honor of talking to many scientists, and you were named, Dr. Weaver, as the one man who could attract the right people for a project under the National Science Foundation to investigate the problem of the flow of scientific information.

I make that merely as a comment—not a question.

MULTIPLE CLEARANCE

Mr. FASCELL. Dr. Weaver, what priority would you assign the elimination of separate clearances in Government and providing an across-the-board clearance for scientists?

Dr. WEAVER. I don't think I am competent to answer that.

Mr. FASCELL. It would be in your list of priorities someplace?

Dr. WEAVER. Yes, but I don't think I am competent to place it.

THE MACHINES OF THE FUTURE

Mr. FASCELL. Would you give us some idea of the future promise of machines for the jobs of search and retrieval?

Dr. WEAVER. Well, I think they have great promise.

Mr. FASCELL. Any time soon?

JOBS MACHINES CAN DO NOW

Dr. WEAVER. There are some jobs that can be done now. If you went out to the Bureau of Standards to the section of Dr. Sam Alexander, you would find out there now operative on an electronic computer, a procedure for examining patents in the general field of organic compounds which can search patents at a rapid rate and can pick out from those patents the ones which are in conceivable conflict with the proposed patent application.

This particular step has already been most skillfully done and this is by no means a trivial task.

I sat there one evening with a group of organic chemists and watched this machine work, and in just a matter of a few seconds it rolled out five patents concerning which the machine said, in effect, you had better look at these because we rather think that these have something that might be in conflict with this application.

A very able organic chemist looked at these, and three of them he recognized at once as being in possible conflict. With respect to the other two, he wondered if the machine hadn't made a mistake. Then he sat down and looked at the structural diagram for a time, and he said "I am not sure that I would have ever seen this if the machine had not pointed it out, but the machine was right. The possible conflict was there."

Mr. FASCELL. I don't know whether I am pleased or frightened, frankly.

Dr. WEAVER. That chemist, incidentally, was Dr. Wallace Brode.

INTERNATIONAL COORDINATION OF ABSTRACTING

Mr. FASCELL. You mentioned that 10 years ago an international coordinating office for science abstracting had been rejected. In the statement of rejection it was stated that the first thing that the United States should do was get its own house in order. Would you explain that?

Dr. WEAVER. Well, we have had a very messy time in the United States in connection with abstracting the various fields of science. Some of them have been done relatively well. This is not a criticism of groups. This is more or less an accident of available resource.

In the biological field, Biological Abstracts has been doing a good job, considering the vast spread of the relevant literature and the available resources.

In chemistry, Chemical Abstracts has been doing a very good job.

In the physical field, we have been depending largely upon our brothers across the sea.

In various other fields, the abstracting has surely been imperfect.

What the National Academy meant was we haven't found out how to do the total job of abstracting very well on a national scale, and why don't we try to do something about this in our own country before we get into it on an international scale.

NATO CLEARINGHOUSE

Mr. FASCELL. You suggested the possibility of a NATO information clearinghouse of some kind. With the military cross-currents in NATO, wouldn't this compound the difficulty we now have?

Dr. WEAVER. This is by no means an easy or clear situation. By and large, the scientist would like to have this under scientific auspices as nearly and as completely as possible. There is no question about that.

On the other hand, scientists have come to realize that science doesn't just belong to the scientists; it belongs to everybody.

Included within "everybody" is the military, and scientists have come to realize that a certain amount of pure scientific research is proper and desirable in military establishments, so that scientists are not as prejudiced against the association with the military as they used to be.

Part of this, of course, has been accomplished by the absolutely superb record of the Office of Naval Research. This was a pioneering effort, and this has been a superb effort.

QUESTION OF SUBSIDIZATION

This, however, does not quite explain my remark about NATO. The reason I said that I thought the NATO auspices offered probably the best now available is for the very realistic reason that I suspect that those are the only auspices under which the money can be produced.

I do not think they are ideal auspices, but from a practical point of view I suspect they are the only ones where you can get enough million dollars to do it.

Mr. FASCELL. How can you reconcile your statement with one made by another witness before this subcommittee who once headed research and development for the Department of Defense? He said one of his difficulties was that basic research had been deemphasized the whole time he was in office—he just couldn't take it. He thought this was very wrong and it was one of the reasons that led to his resignation.

Dr. WEAVER. You can't hope that I will disagree with him.

Mr. FASCELL. No, sir. But I was thinking that we have to decide what is the proper emphasis on basic research before we even approach the problem of the flow of scientific information.

ELECTRONIC COMPUTERS

You said something about the use of electronic computers for solving the information problem. Would you elaborate on that?

Dr. WEAVER. I have already given this one example out at the Bureau of Standards. The basic facts there would seem to me to be in essence very simple. What can a human being do when he is trying to locate printed material? He can look at cards in a card catalog in a library about one a second. He can't read everything on the card in a second, but he can look at it and decide whether he is interested.

Try that, you will find you can turn over about one a second, making up your mind whether you are interested. What is characteristic of that process? It is a scanning rate (which would be the technical term for this) of about one a second, utilizing the almost incredible associative powers of the human mind. What goes on in the mind when you decide you are interested, is an exceedingly complicated business of association. Machines are almost completely the opposite of this. Instead of scanning one a second they can scan a million or 10 million a second. If anybody wanted a hundred million a second there is no essential difficulty about that faster rate. Machines can perform this incredible faster rate, but the machine has no associative power whatsoever.

Mr. FASCELL. Not yet.

LACKS ASSOCIATIVE POWER

Dr. WEAVER. Not yet. It has only pure logical power of the strict implicative sort. It can work out a syllogism "if A and B, then C." But it can't look at A and say "That reminds me of something interesting."

The trick is to capitalize on this tremendously rapid scanning rate. The machine's tremendous capacity to deal with pure logic, however complicated, and get some process which will never be a substitute for the human mind—I put this in to comfort the lawyers, Mr. Fascell—but which will be able to supplement the human mind in a very important way.

NATO CLEARINGHOUSE CONCEPT

Mr. FASCELL. Getting back to the possibility of a NATO clearinghouse, one of the most difficult problems that I could envision would be conflicts between countries on the use or the release of information.

For example, the current controversy over release of information on thermonuclear fusion which now exists between the United States and England.

Dr. WEAVER. Don't you suspect that may be an example of the question you were asking earlier as to whether we have really treated our friends right?

Mr. FASCELL. That is right. But I would be very reluctant to get into the type of clearinghouse which would require the unanimous approval of all the nations involved for the release of information. It is bad enough now.

Dr. WEAVER. The greatest disservice I could render to you gentlemen would be to say anything that makes it sound as though this is easy. I do not think the problems are easy, gentlemen, they are hard.

Mr. FASCELL. But it is worth thinking about.

Dr. WEAVER. And it is worth trying.

Mr. FASCELL. That is all the questions I have, Mr. Chairman.

Mr. Moss. Mr. Hoffman?

LIMITATIONS OF NATURAL RESOURCES

Mr. HOFFMAN. I understood your testimony to indicate that we might someday come to the end of our natural resources. I got that from the thought you said we are digging wells deeper, going farther

for coal and iron. Is that your idea, that our natural resources are limited?

Dr. WEAVER. Our natural resources, using that phrase in the classical sense, are certainly limited. There is, after all, a certain definite amount of iron in the structure of this planet. Not an infinite amount, a finite amount. There is a certain amount of petroleum and other things. They are certainly limited if you use that phrase in the classical sense. The great thing about science is that it removes the limits of this classical definition of resource. Many of the things we have been interested in as resources we have been interested in because they furnish us with power; and for a long time we thought that the only place we could get power was by burning up wood on coal, letting water run downhill, burning up oil, and so forth. But we now know we have a much broader concept of the resource for power, and science has provided it.

Mr. HOFFMAN. But the substance is limited.

Dr. WEAVER. The substance is limited.

Mr. HOFFMAN. There is no impertinence in this question at all. Have you ever been hungry in the last 30 years or without proper clothing or home?

Dr. WEAVER. Only in a purely temporary and accidental sense. In a serious sense, no.

Mr. HOFFMAN. Now, we get letters day after day. A typical letter will say, for example, I fought in the First World War. I get a pension of $78. I worked awhile and I get social security of $36. The two combined are not enough to give the wife and I—and we are no longer able to work, or we can't get a job, which often is true. We have that group. Then we have, without naming them, many, many other groups which we all know about, and they come to us for money. Assuming, if I may, that the power to get dollars through taxation is limited, how shall we meet your demands here? In five places you asked for more money, sums that don't amount to anything.

Dr. WEAVER. Not very much, sir.

Mr. HOFFMAN. That is what I was just about to say. To me a dollar was quite a sum when I came here. But today a million dollars doesn't mean a thing, not a thing. With all these various demands, have you any guide by which a Member of the Congress can sort out these things? I have to choose, for example, between voting to give you a certain—when I say you I don't mean personally, of course—your organization a certain sum and increasing either pensions or social security. How are we going to decide? There is no machine to solve that thing so far as I know. How can we properly differentiate?

NATIONAL SCIENCE FOUNDATION PRAISED

Dr. WEAVER. I have the deepest respect for the seriousness with which the Members of Congress approach these problems. They are certainly terribly difficult. The only thing I can say in reply to you is that when you have as good an organization as the National Science Foundation with a board that is as good as that board is, then you should take their recommendations most seriously. Permit me just for a moment to disassociate myself from that board, for I have only been a member for a couple of years. There are 18 or 19 men in that board. I have never heard in their discussions one single note except

the primary question, what is good for science and good for our country. I have never heard more unselfish or more devoted or more careful analyses of what we ought to do in and for science. When that organization, through Dr. Waterman, comes to you and says, "We have, with the best social sense of responsibility we are capable of bringing to bear, decided that you men on the Hill ought to give us a little more money in this category and a little more money in this category, then you should give heed. When we have decided that you ought to be a little less meticulous or a little less fussy about—well, I will mention two things that I realize are sensitive points up on the Hill, travel and periodicals. When the NSF asks for more money in those two categories I think, sir, you can trust them. I think you ought to give it to them.

Mr. HOFFMAN. I go along with you on that even though we have to cut our own travel a little bit. But it gets on this other one now. I can disregard the pressure of certain groups that want more money.

Dr. WEAVER. Sure.

Mr. HOFFMAN. But I have difficulty. For example, the President says now we must hold wages down and so on and so forth and then he comes along with a suggestion that we must increase the compensation of the Federal employees and I am lost again. Don't you see? When you get to these folks who write in, some of whom I happen to know or inquire about and learn about, and I know they just can't get the things they need to eat. It isn't any campaign talk or anything of that kind at all. That situation exists. There are many other things.

Dr. WEAVER. Those certainly are moving appeals.

Mr. HOFFMAN. For example, I voted against Federal aid to education. I think it would be far better to give your group more money, cut off on that one and many others. But it is a practical question.

Dr. WEAVER. May I put one more remark into the record on this subject of travel?

Mr. HOFFMAN. I think we could save ample funds for the organizations you suggest by just cutting off, for example, some of this military travel. I am not talking about Congressmen, I am talking about the boys who fly to hunt and fish and so forth. Like, for example, I have a distinct recollection of a couple of officers flying up to Michigan years ago to spend the weekend with their families. It happened that the plane burned up there and attention was called to it and that ended it. If you have a practical way by which we can cut out some of the more needless, wasteful expenditures so as to get the funds for the organizations for which you speak, it would be mighty helpful.

Dr. WEAVER. May I make this one remark?

Mr. HOFFMAN. Pardon me for interrupting.

Dr. WEAVER. Pardon me. I am afraid I interrupted you.

Mr. HOFFMAN. You didn't.

FOREIGN TRAVEL PROGRAM

Dr. WEAVER. In fiscal 1957 the National Science Foundation had, for foreign travel of United States scientists to international meetings abroad, the total of $90,000. There were 49 international congresses during that year. They were able to assist just a few under 200 scien-

tists which means just about 4 United States scientists to each one of these meetings with a total assistance which averaged about $450 apiece.

In other words, this was no very lush business, gentlemen. This was $450 apiece average for a foreign trip.

That is the representation that American science had at those 49 international meetings in fiscal 1957. We can't play our role in science in the world on that basis.

Mr. HOFFMAN. Are you willing to go one step further, for example, and this is the hard part of it: Are you willing to say your society will say officially that we need, for example, a hundred thousand dollars and you can obtain this money if you will just see that Admiral X or General Y doesn't go here and there, point out a specific place. It surely would be helpful. When we try it they say why don't you clean your own house, your congressional house. Maybe we are in no position to criticize the military folks like you would be. You haven't had any wasteful junkets we will say.

Dr. WEAVER. I am afraid scientists wouldn't make friends very rapidly on that basis.

Mr. HOFFMAN. No, you wouldn't, but you might get your money. Tell us where we can cut it out from some other fellow and give it to you. That may seem silly to you. This thing of getting money for some group, no matter how meritorious your request——

Dr. WEAVER. It has to come from somebody.

Mr. HOFFMAN. You don't have the votes. You don't put the heat on. And the public, according to your own statement, pays little attention to your statements about science.

SCIENTISTS SHOULD BE MORE PERSUASIVE

Dr. WEAVER. I have the deepest sympathy for your problem. At the moment I don't see anything for the scientist to do except to be more persuasive than the other fellow, on the basis of the facts.

Mr. HOFFMAN. I found over on the floor some things are dropped if they are exposed—the press over here has a terrific influence and they point out some silly, wasteful, ridiculous thing, assuming that a Congressman ever did that, and when they point it out, we just let go, we don't do it any more, at least we cover it up if we do. It would be helpful if you could point out specific areas where the funds could be found.

That is all. Thank you, Mr. Chairman.

DECLASSIFICATION COMMISSION

Mr. MOSS. Doctor, I have a few questions. Dr. Berkner made two suggestions which were seconded by Dr. Hughes and supported substantially by Dr. Brode. One would be the creation of a Declassification Commission with broad representation from science, business, industry, and Government. The Commission would determine the areas within the Government where classification of information would be required. Do you feel this proposal would be a constructive step in solving the problem of what to classify and what to make available?

Dr. WEAVER. If such a commission could be set up on a high enough level.

Mr. Moss. It would have to be directly under the President.

Dr. WEAVER. And if the climate of Washington is such that it will be worth their while to do a hard job. In other words, if there is a reasonable assumption that serious attention would be paid to what they said, I think it would be a good thing to do.

Mr. Moss. You define three areas, the clear field of basic science where you suggest there should be no classification.

Dr. WEAVER. Yes, sir.

Mr. Moss. And no use of the need-to-know criteria.

Dr. WEAVER. Yes.

Mr. Moss. Then you stated there is the gray area between basic science and its specific application to hardware.

Dr. WEAVER. That is right. It is in that intermediate area where the problems lie.

Mr. Moss. In this gray area where we apply classification and restrict the availability of information: Do we diminish the Nation's opportunities for greater scientific progress?

Dr. WEAVER. I think that question is so important that it deserves the careful study that you have suggested. My conviction prior to such a study is that the answer is "Yes."

Mr. Moss. It is a matter which would require the immediate attention of such a commission.

Dr. WEAVER. Yes.

SCIENCE INFORMATION STUDY PROJECT

Mr. Moss. It was also suggested by Dr. Berkner that to bring about the greater use of the agencies you have already mentioned that generate and disseminate information outside the security areas, that a Government coordinating board or commission be established. I don't recall any specific suggestion on where such a group would be placed, authough I assumed it would be possible to create it under the National Science Foundation or some other existing agency. But to give to it the responsibility of directing studies and activities which would solve some of these perplexing problems of how to handle the avalanche of information to better abstract, to better translate and to better index and recover data on a usable basis.

NSF STUDY OF INFORMATION PROBLEM

Dr. WEAVER. I think the function is very important. I am not convinced that it is necesary to set up any new organizational mechanism to deal with it. I think if the division of information which now exists within the National Scence Foundaton has sufficient support for sufficient staff that it is an ideal and an ideally located agency to deal with this problem now.

Mr. Moss. How urgent do you feel this problem of scientific information is at the moment? Will we continue to slip behind until we solve it?

Dr. WEAVER. Yes. I think most scientists feel as though they were struggling to keep one nostril above the level of the water, and they figure out from day to day some way in which they can move up an eighth of an inch higher and get a wee bit more margin. We are working against very bad odds there. I think it is an urgent

problem. I think we will slip behind until we get some more effective ways of dealing with it.

Mr. Moss. Do you feel that science has exhausted its own resources and must now seek some form of subsidy in effecting solutions to these problems?

Dr. WEAVER. I am afraid I wouldn't know how to answer that question. In such a context I don't know what the word "science" means.

Mr. Moss. You have mentioned recognized organizations that have devoted a considerable amount of their time, their energy, and I assume their resources, to solve this problem.

Dr. WEAVER. Yes.

Mr. Moss. Apparently their progress has not been encouraging. It is to these organizations of science I refer to in this instance. Do you feel the Government should just let things drift without stepping in to give assistance wherever possible to put this mass of information into a usable form? Do you think the private resources of these groups have been exhausted and there is a need right now for outside help from Government? Will the underwriting of some of the costs by Government effect a solution?

Dr. WEAVER. I wouldn't feel happy about saying that the resource has been exhausted because I don't belong to the individuals, if there are any such, who think the only way to get forward with life is to come to Washington. I think it is a very fine thing to have the vitality of American life operate in all sorts of diverse ways. I happen to be associated with three private foundations and I am proud of those associations. The Rockefeller Foundation, the Sloane Foundation, and the American Council on Library Resources which is supported by the Ford Foundation, all have activities in the field. They are all doing something. I wouldn't be prepared nor would I feel happy to say that any one of those three foundations is at the moment entirely exhausted. I do feel, however, that this problem is so large and is so urgent that it cannot be properly dealt with through private sources or through private agencies of that sort. I think it is so importantly related to our overall national progress that it is a proper matter of concern for the Federal Government and that in some cases, funds of such a magnitude are necessary that nobody but the Federal Government can produce them.

So I feel very strongly that the Federal Government should be active in this field.

Mr. Moss. Now, could we have a priority of where you would use these funds, where you feel the most urgent need exists?

Dr. WEAVER. I hesitate to give a spontaneous reply to a question that I think is as important as that question.

Mr. Moss. Would you like to think it over and supply the subcommittee with a response setting forth your priorities?

INTERNATIONAL INFORMATION MEETING

Dr. WEAVER. I would be quite willing to attempt that. I doubt that within a very short length of time even such a reply can be produced. This conference of which I spoke and which is being held under the auspices of the National Academy has been under detailed planning for nearly 2 years. This is a very serious enterprise, and

I think that a great deal of illumination on priority is going to come out of that meeting. This will be an international meeting of considerable size—7 or 8 sections. It is one of those unusual meetings of which one can truthfully say that most of the work happens before the meeting takes place.

Mr. MITCHELL. This is the meeting next fall?

Dr. WEAVER. Yes. I think that meeting should contribute a great deal to clarification on priorities and actually I think it would be foolish for me to presume to anticipate the findings of that meeting.

AREAS FOR FEDERAL ASSISTANCE

Mr. Moss. Without assigning specific priority could you give us 3 or 4 areas where you feel funds are necessary? You mentioned an overall study to make certain determinations as to how the scientist uses material and in what form it might be most helpful. Would that be a priority item?

Dr. WEAVER. There is no difficulty at all in furnishing 2 or 3 things that I think are worth doing, and worth doing promptly.

Mr. Moss. Without holding you to a priority number on each item; could you recapitulate a few of them for the subcommittee?

SUPPORT TO NATIONAL SCIENCE FOUNDATION

Dr. WEAVER. Yes. I have already mentioned the fact that I think it is very important for Congress to make clear to the National Science Foundation that their request for travel funds is accepted not in the spirit of suspicious reluctance, but that they believe this is a right thing to do. Secondly, I think it would be wonderful if one of the relevant committees that deals with the National Science Foundation would say to Dr. Waterman, the work of the Moss committee has highlighted to us the importance of activities in this field of communication. Is it clear to you that we are interested in this? Is it clear to you that if your department of information needs more money that we would wish to know about this? The question of support for periodicals has been one of these touchy items. This is one of the things you don't go over to the Bureau of the Budget and kind of casually say, "I am going to increase that by 20 percent." Because you know perfectly well that the Budget Director views that as a sensitive item. So Congress might make it clear, all up and down the line, that they believe in supporting scientific literature.

I would like to see you assure that in this department of information of the National Science Foundation they undertake vigorously basic research on the long-range problem of storage and retrieval of knowledge.

Gentlemen, just get the picture: I attended a meeting of the National Science Foundation on Monday and let me tell you what happened at it. There were 75 requests approved in the field of biology and medicine for a total of $1,269,500. There were 149 requests approved in the general area of physics, mathematics, engineering, and IGY for a total of $9,407,454. And in the Department of Information there were two projects approved with a total of $71,450.

Mr. FASCELL. Mr. Chairman, may I ask a question?

At this point I am somewhat confused. I don't know whether to blame the National Science Foundation or the Bureau of the Budget. I was under the impression that the National Science Foundation had made adequate requests but in each instance had been cut down by the Bureau of the Budget.

Dr. WEAVER. I wish Dr. Waterman were here because I have no right to speak for the National Science Foundation. I am just one of 18 working stiffs, you see, and I really have no authority to speak for the National Science Foundation.

BUDGET BUREAU ACTION

Mr. FASCELL. Let's put it this way, the first regulator you have to get past is the Bureau of the Budget, isn't it?

Dr. WEAVER. I believe that is right.

Mr. FASCELL. And so far you haven't been able to do that?

Dr. WEAVER. That is correct.

Mr. MOSS. Would you like to have that information developed and supplied to you by the staff?

Mr. FASCELL. I think it would be important for a proper perspective on this situation.

Mr. HOFFMAN. Was their request turned down? These figures he gave there.

Mr. MOSS. Those were the allocations within the National Science Foundation from the funds appropriated to them for specific scientific purposes.

Mr. FASCELL. I think it would be helpful for the record, Mr. Chairman, to have that information developed by the staff and put in the record here. (See exhibit III.)

TRANSLATION PROBLEM

Mr. MOSS. That will be done.

I have just one additional question, Dr. Weaver: Are we translating a sufficient number of publications coming into this country from Russia and from other nations?

Dr. WEAVER. No, we are not. But we are not doing a horrible job. We are doing a pretty good job. We are not doing a very good job. There has been a lot of discussion in exactly the same division of the National Science Foundation of this problem. Is this one of these situations that calls for one of these great global agencies? They have come to the conclusion—and I think it is a very sound conclusion—that it probably would be better to back the groups that are interested in subject matter fields. Let the chemists themselves primarily and in the first instance be responsible for translation of chemical material, the National Institutes of Health in the first instance be responsible for translation of stuff in the general biological and medical field, and so forth; but set up in the National Science Foundation a coordinating agency that looks at this whole thing and says are there gaps that somebody should look at and is it necessary to furnish some financing to kind of equalize the market here? In chemistry you can put this on a self-supporting basis because there are enough chemical industries eager enough to know what the Russians are saying so they will put money into it. But

what industries will put it in for translation in astronomy and other basic fields? You have to have price supports in this area to kind of equalize it. I think this is a sensible way for the National Science Foundation to go about it. I think we need more. In sum, we are not doing enough, but we are moving in a pretty good direction.

Mr. Moss. Do you have any further questions?

Mr. FASCELL. No.

Mr. Moss. Mr. Hoffman.

Mr. HOFFMAN. Yes. You don't advocate the abolition of the Bureau of the Budget, do you?

Dr. WEAVER. I didn't wish to give that impression. I have to work with the comptroller in the Rockefeller Foundation, you realize; and I am sure that this is proper.

Mr. HOFFMAN. That isn't the only reason, is it?

Dr. WEAVER. No, sir. As I said previously, it is the clear duty of Congress to safeguard the use of public moneys.

Mr. HOFFMAN. To do what?

Dr. WEAVER. To safeguard the use of public moneys. I think that is a very important duty.

(Discussion off the record.)

Mr. HOFFMAN. The money that you referred to as being helpful to science came as I understood you from three foundations. You mentioned three, did you not?

Dr. WEAVER. Yes.

Mr. HOFFMAN. Those funds were all accumulated by someone engaged in private enterprise?

Dr. WEAVER. That is right.

Mr. HOFFMAN. And that is the main source of your money today, isn't it?

Dr. WEAVER. No. The main source of support for science today is the Federal Government.

Mr. HOFFMAN. You get more from the Federal Government than you do——

Dr. WEAVER. Yes.

Mr. HOFFMAN. I don't know where I got the idea from your testimony that you were just a poor relation, you didn't get much of anything.

Dr. WEAVER. No.

Mr. HOFFMAN. Your statement is that you get a considerable sum but not enough?

Dr. WEAVER. That is right.

Mr. HOFFMAN. That is common to every organization, I guess. The Ford Foundation's money, of course, came from the automobile industry, the Ford organization, originally. If we take this present plan to divide the profits that has been suggested—you are familiar with that?

Dr. WEAVER. I have read it in the papers.

Mr. HOFFMAN. If we accept that and divide up among these four groups, let's see, that was the workers, the executive officers and the stockholders and customers. If they divide that money, there wouldn't be any foundations hereafter. Where would anybody get money for foundations, to establish foundations?

Dr. WEAVER. I am testifying this morning as a scientist.

Mr. HOFFMAN. I am asking you now as an ordinary individual, a taxpayer.

Dr. WEAVER. I think it is very important for scientists not to misuse their professional position and make statements in areas in which they are not at all expert. I am not expert in this area. I have nothing but sort of private intuitions and hunches.

Mr. HOFFMAN. You don't think you have to be an expert, do you, to understand how to accommodate a little money?

Dr. WEAVER. I have had almost no experience in that field either.

Mr. HOFFMAN. I think it would be well if you would just think that over as an ordinary citizen because in addition to being a scientist you are a taxpayer, you realize that, of course.

Dr. WEAVER. Amen.

Mr. HOFFMAN. That was no profound statement at all.

All right, that is all.

Mr. MOSS. Dr. Weaver, we are indebted to you for your appearance here and I want to thank you for a most challenging statement.

Dr. WEAVER. It has been a great pleasure to me.

Mr. MOSS. It has been very helpful to the subcommittee.

The committee will now stand adjourned.

(Whereupon, at 12:20 p. m., the subcommittee adjourned.)

EXHIBITS

EXHIBIT I

(Excerpts from President Eisenhower's state of the Union message on January 9, 1958)

SCIENTIFIC COOPERATION WITH OUR ALLIES

Fifth: It is of the highest importance that the Congress enact the necessary legislation to enable us to exchange appropriate scientific and technical information with friendly countries as part of our effort to achieve effective scientific cooperation.

It is wasteful in the extreme for friendly allies to consume talent and money in solving problems that their friends have already solved—all because of artificial barriers to sharing. We cannot afford to cut ourselves off from the brilliant talents and minds of scientists in friendly countries. The task ahead will be hard enough without handcuffs of our own making.

The groundwork for this kind of cooperation has already been laid in discussions among NATO countries. Promptness in following through with legislation will be the best possible evidence of American unity of purpose in cooperating with our friends.

WORKS OF PEACE

My last call for action is not primarily addressed to the Congress and people of the United States. Rather, it is a message from the people of the United States to all other peoples, especially those of the Soviet Union.

This is the spirit of what we would like to say:

"In the last analysis, there is only one solution to the grim problems that lie ahead. The world must stop the present plunge toward more and more destructive weapons of war and turn the corner that will start our steps firmly on the path toward lasting peace.

"Our greatest hope for success lies in a universal fact: The people of the world, as people, have always wanted peace and want peace now.

"The problem, then, is to find a way of translating this universal desire into action.

"This will require more than words of peace. It requires works of peace."

Now, may I try to give you some concrete examples of the kind of works of peace that might make a beginning in the new direction.

For a start, our people should learn to know each other better. Recent negotiations in Washington have provided a basis in principle for greater freedom of communication and exchange of people. I urge the Soviet Government to cooperate in turning principle into practice by prompt and tangible actions that will break down the unnatural barriers that have blocked the flow of thought and understanding between our people.

EXHIBIT II

(Exchange of correspondence between Chairman John E. Moss and the National Science Foundation on a conference in Philadelphia to form a Federation of Indexing and Abstracting Services)

DECEMBER 26, 1957.

DR. ALAN T. WATERMAN,
Director, National Science Foundation, Washington, D. C.

DEAR DR. WATERMAN: I have been informed that the National Science Foundation is considering a request for funds to help finance a conference of major American scientific and technical abstracting and indexing services. The meeting is scheduled for Philadelphia on January 20–30, 1958.

The House Government Information Subcommittee, of which I am chairman, recently intensified its study of the availability of scientific and technological information. One area we are studying is the abstracting and indexing of the great volume of scientific information available from agencies both inside and outside the Federal Government.

I believe the proposed meeting would help develop a greater flow of scientific information. I hope the National Science Foundation will give all possible favorable consideration to the request for assistance.

Sincerely,

JOHN E. MOSS, *Chairman.*

NATIONAL SCIENCE FOUNDATION,
OFFICE OF THE DIRECTOR,
Washington 25, D. C., January 7, 1958.

Hon. JOHN E. MOSS,
Chairman, Government Information Subcommittee,
Committee on Government Operations,
House of Representatives, Washington 25, D. C.

MY DEAR MR. MOSS: In response to your letter of December 26 expressing the hope that the National Science Foundation will give favorable consideration to the request for funds to help finance a conference of major American scientific and technical abstracting and indexing services, I am pleased to inform you that the Foundation has made a grant of $11,400 to Biological Abstracts for the support of the conference in question. The work of organizing the meeting is being undertaken by Biological Abstracts. The meeting will be held in Philadelphia at the Sheraton Hotel January 29, 30, and 31. Representatives of 14 of the major abstracting and indexing services in the United States are to attend, as well as representatives of fields of science that are contemplating starting new services.

We believe that the conference will help to develop needed information about current abstracting and indexing activities. The participants will endeavor to assess the adequacy of the present abstracting and indexing services in the various fields of science and technology; to determine the scope of the services that ought to be provided in each field; to provide estimates of the additional effort and services required to realize the objective of systematic and prompt coverage of the world's scientific and technical literature; and to reach agreement on the best ways of achieving greater cooperation among the various abstracting and indexing services.

I am glad to know of your interest in this conference and hope that its results will be helpful to all concerned with the development of more effective scientific information services in this country.

Sincerely yours,

ALAN T. WATERMAN, *Director.*

EXHIBIT III

(Record of money requests by National Science Foundation and disposition by the Bureau of the Budget)

NATIONAL SCIENCE FOUNDATION, WASHINGTON, D. C.

History of salaries and expenses appropriation, fiscal years 1950 through 1958

	National Science Foundation appropriation request	President's budget	Total appropriation voted by Congress
Fiscal year:			
1951 [1]	$500,000	$475,000	$225,000
1952	14,780,000	14,000,000	3,500,000
1953	15,000,000	15,000,000	4,750,000
1954	15,000,000	15,000,000	8,000,000
1955	20,600,000	14,000,000	12,250,000
1956	24,650,000	20,000,000	16,000,000
1957	58,791,000	41,300,000	40,000,000
1958	60,000,000	65,000,000	40,000,000

[1] The Foundation received its 1st appropriation in fiscal year 1951 in the amount of $225,000 for administrative expenses only.

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